VOLUME 17 / NUMBER 11
JUNE 8, 1979
ACC. NOS. N79-19988 TO N79-20986

STAR
AN ABSTRACT JOURNAL

Scientific and Technical Aerospace Reports

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Scientific and Technical Aerospace Reports, Volume 17, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Information Systems Company.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1981.

US ISSN 0036-8741

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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1503
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1503
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1504
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1506
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1506
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 1507
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1509
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 1509

Note: N.A. means that no abstracts were assigned to this category for this issue.

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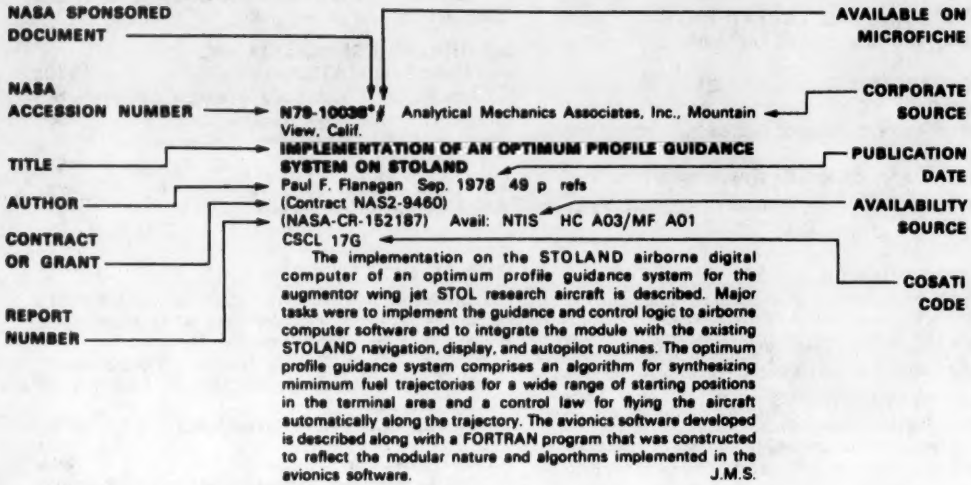
TYPICAL CITATION AND ABSTRACT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AVAILABLE ON MICROFICHE
NASA ACCESSION NUMBER
N79-10038*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
CORPORATE SOURCE
TITLE
IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
PUBLICATION DATE
AUTHOR
Paul F. Flanagan Sep. 1978 49 p refs
CONTRACT OR GRANT
(Contract NAS2-9460)
AVAILABILITY SOURCE
REPORT NUMBER
(NASA-CR-152187) Avail: NTIS HC A03/MF A01
CSCL 17G
COSATI CODE
The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorithms implemented in the avionics software. J.M.S.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, NAVY VEHICLE DESIGN AND CONSTRUCTION - STRAKE AERODYNAMIC DESIGN

S.B. Spangler, Nielsen Engineering & Research Inc., *850 Maude Ave., Mountain View, California* 94040 (DN875420; N00014-78-C-0388)

The use of strakes, or leading-edge extensions, on recent fighter-type aircraft has been shown to improve greatly the high angle of attack aerodynamic characteristics of these aircraft. The beneficial effects stem from the formation of leading-edge separation vortices on the highly swept strake and the subsequent interaction of these vortices with the flow over the wing to produce significant lift on the wing-strake to considerably higher angles of attack than is the case for the wing alone. These benefits have been derived primarily by cut-and-try methods in wind tunnel tests. The understanding of the fundamental fluid flow phenomena necessary to do a priori design of strake-wing-body combinations does not exist. The objective of this investigation is to develop the capability to do systematic practical strake design at the aircraft preliminary design phase.

A coordinated experimental-theoretical program is proposed to develop methods for describing the flow over a highly swept strake/body combination with rounded strake leading edges. Preliminary water tunnel and wind tunnel tests will be conducted. These data will provide sufficient initial understanding to develop an analytical preliminary design model.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0002, AERODYNAMICS, AEROELASTICITY AND STABILITY OF HANG GLIDERS

H. Ashley, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NSG 2359)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0003, IMPROVED HARNESS RESCUE LINK

D. Goodrich, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN895416)

Design and qualify a helicopter pick-up link for use on the MA-2 torso harness which incorporates fleet requirements regarding versatility, strength and non-interference on the other aircrew equipment.

Use surveys, interviews, and on-site inspections and UR data to define specific fleet requirements. Design and test appropriate prototype configurations. Select superior configurations and prepare design specifications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0004, RESPONSE STUDIES OF ROTORS AND ROTOR BLADES WITH APPLICATIONS TO AEROELASTIC TAILORING

P. Friedmann, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Mechanics, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 1578)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0005, RESEARCH PROGRAM IN LAMINAR FLOW CONTROL

H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NSG 1585)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0006, DISTRIBUTED STORE AIRLOADS

W.B. Baker, U.S. Dept. of Defense, Air Force, Armament Lab., *Eglin Air Force Base, Florida* 32542 (DF629000)

Air Force function - aircraft-stores compatibility. Opportunity -structurally efficient store design and certification of stores on aircraft. Goal- development of analytical and wind-tunnel techniques to obtain distributed store airloads. How work contributes - provides more accurate airloads data to improve structural design of stores and reduce flight envelope restrictions.

The approach will be to conduct pressure model and segmented store model wind-tunnel tests to determine the best wind-tunnel technique to obtain distributed airloads. Resulting accumulated data will be compared to the analytical results. The analytical technique will be based on the Computer Aided Missile Synthesis (CAMS) computer program. This program will be modified to calculate the airloads distributed over the store while in an interference flow field. Existing and future flow field data will be used as inputs into this modified computer program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0007, TRAILING VORTEX INTERACTION AND DECAY

J.D. Iversen, Iowa State University of Science & Technology, School of Engineering, Dept. of Aerospace Engineering, *496 Town Engineering Bldg., Ames, Iowa* 50011 (NSG 1582)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0008, CORRELATION OF THEORETICAL PREDICTION WITH TUNNEL DATA AND FLIGHT DATA ON THE ADVANCED TECHNOLOGY LIGHT TWIN-ENGINE (ATLIT) AIRPLANE

J. Roskam, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NSG 1574)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0009, SUPERSONIC BURNING IN SEPARATED FLOW REGIONS

G.W. Zumwalt, Wichita State University, School of Engineering, Dept. of Aeronautical Engineering, *1845 Fairmont N., Wichita, Kansas* 67208 (NSG 1575)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0010, AUTOMATED TERMINAL SERVICE (ATS) SUPPORT IN THE AREA OF THE ATS OPERATING SYSTEM RSX-11M

Unknown, Automated Sciences Group Inc., *8555 16th St., Suite 713, Silver Spring, Maryland* 20910 (FA78WAI-832; FA161212 (TRAIS NO.))

An Automated Terminal Service (ATS) system to serve as an alternative to new towers at airports reaching tower eligibility. ATS provides traffic advisory management, and threat detection services to achieve the safety of a newly installed tower. The contractor shall provide support for maintaining the overall performance of the ATS-RSX-11M operating system as issued and documented by Digital Equipment Corporation. This responsibility has two parts: (1) system generation, and (2) system diagnostic testing. The supporting activity has three parts: (1) patching system programs, (2) modifying existing system programs to meet environment considerations, and (3) integrating new system programs into the RSX-11M operating system.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0011, IMPROVEMENT OF SHORT-RANGE FORECASTS OF THUNDERSTORMS

Unknown, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, *8060 13th St., Silver Spring, Maryland* 20910 (FA78WAI-886; FA161246 (TRAIS NO.))

At the present time the FA Air Traffic Controllers utilize only real-time information about thunderstorms and associated hazards in directing air traffic. Accurate and reliable short-range (0-2 hour) forecasts of thunderstorms, especially in the 0-30 minute time period with 10 minute updates, can aid the controller in the safe and expeditious movement of air traffic. The 0-30 minute forecast can be used in the air traffic control system 1) to expedite the movement of aircraft to avoid the hazards of thunderstorms as they move through the controlled airspace, and 2) selecting holding patterns that will minimize the effect of thunderstorms.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0012, F-4 RESPONSE TO GROUND INDUCED LOADS

N.H. Zimmerman, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF142310; F33615-78-C-3222)

The basic mission of this overall effort is to determine the dynamic response of combat loaded aircraft while operating on bomb-damaged runways (BDR) that have been repaired in accordance with established procedures (AFR 93-2). Computer simulation studies have shown that under certain runway repair conditions, structural failures may occur to these aircraft (in this case, the F-4C). The objective of this study, then, is to verify the computer simulation studies and the failure criterion used in these studies. Runways are primary targets in a conflict. If our established runway repair procedures may cause aircraft structural failures, our Tactical Commands' emergency response capabilities could be adversely affected.

The approach to be used will be to perform an independent computer analysis, simulating the same conditions as the previous study to verify results. In addition, the 'safe/unsafe' structural failure criterion used in the earlier study will be confirmed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0013, HIGH ANGLE OF ATTACK DESIGN AERODYNAMICS

M.E. Givan, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF141390; F33615-78-C-3015)

Historically, fighter aircraft high angle of attack limits have been defined in flight tests with the attendent risk of aircraft loss. The development of rational criteria to accurately predict our combat aircraft performance in the extreme angle of attack range will lessen this danger. The objective of this work effort is to develop high angle of attack design guidelines for future USAF fighter aircraft from a compilation of existing experimental data.

Existing wind-tunnel data on the F-4 and F-15 series aircraft configurations will be collected, correlated and analyzed for trends and sensitivities of flying quality parameters to geometry changes. Special attention is to be given to those configuration items responsible for the non-linear flight characteristics observed at high angles of attack.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, TRANSMISSION OF SOUND IN HIGH-SPEED FLOWS

W. Eversman, University of Missouri, Rolla Campus, Graduate School, *103 Parker Hall, Rolla, Missouri* 65401 (NSG 3231)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0015, COMMAND AND STABILITY AUGMENTATION TECHNIQUES FOR AIRCRAFT WITH CONTROL SATURATION

R.F. Stengel, Princeton University, Graduate School, *205 Nassau Hall, Princeton, New Jersey* 08540 (NSG 1587)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0016, THE CORAN SYSTEM

Unknown, General Electric Co., *French Rd., Utica, New York* 13502 (FA78NA-5037; FA161396 (TRAIS NO.))

Furnish a 'CORAN' system as described in the attachment hereto entitled 'IV.' EQUIPMENT DESCRIPTION' pages 4-1 through 4-4, together with provisions for connection to a 400-cycle, 115-volt power source in an FAA Aircraft. All interconnection between sub-assemblies of the CORAN system shall be furnished by the contractor. Installation to be by FAA personnel, with system check-out and flight-test participation by the contractor. Existing contractor documentation consisting of system block diagrams, and interconnection cable listings shall be furnished by the contractor with the system. System ground speed recorder interface shall be a parallel digital TTL buffer with an RS-232 connector.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0017, E-3A OMEGA NAVIGATION SUPPORT

P.A. Kossey, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF903950)

The objective of this SPO support is to assess the impact of ionospheric disturbances and propagation anomalies on the E-3A's OMEGA navigation system, and to recommend procedures to minimize their effects upon the system's operational performance.

Data will be taken with a ground monitor system developed by ETEE, during flight tests of the E-3A OMEGA navigation system. This data will be used to aid in the assessment of the capabilities and limitations of the aircraft's OMEGA system. ETEE

will provide information on the nature and severity of ionospheric disturbance effects on the propagation of OMEGA navigation signals and will develop techniques/recommendations to minimize those effects on an operational basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

1.0018, OPTIMUM NACELLE SHAPES AND FLOW PORT LOCATIONS FOR MINIMUM DRAG AND EFFECTIVE ENGINE COOLING FOR GENERAL AVIATION AIRCRAFT
F.D. Smetana, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Mechanical Engineering, *Raleigh, North Carolina* 27607 (NSG 1584)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0019, EVALUATION OF A GOVERNMENT-OWNED AUTOMATIC LANDING DIRECTION INDICATOR (ALDI)
Unknown, Marion City Government, *Marion, Ohio* 43302 (FA78NA-AP-3; FA161200 (TRAIS NO.))

The purpose of this agreement is to permit the FAA to conduct an evaluation of a government-owned Automatic Landing Direction Indicator (ALDI). The site for this evaluation effort is the Marion Municipal Airport, Marion, Ohio. The evaluation efforts will entail the use of General Aviation Aircraft under normal daily operations at the Marion Municipal Airport. Questionnaires and/or individual subjective opinions will be asked of tenants and pilots using the Marion Municipal Airport; and the ALDI system will be evaluated. This test phase is a form of in-service testing to determine if the ALDI is an aid to the pilots and/or the airport operation.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0020, SIMULATION OF BIRD IMPACT ON AIRCRAFT TRANSPARENCIES
J.P. Barber, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF137660; F33615-78-C-3402)

Air Force flight missions involve high-speed, low-altitude operations. Under these conditions, bird impacts on aircraft transparent crew enclosures pose a significant hazard and have resulted in unacceptable losses of aircraft and aircrew. The objective of this work unit is to develop math models for bird impact loads on aircraft transparencies. Utilization of existing computer methods for transparency design is contingent upon the availability of such bird loading models. These computer design methods will allow design of transparencies having improved bird resistance and will provide significant savings by reducing the costly empirical development historically required for transparency design. The availability of transparencies having improved bird resistance will reduce, to an acceptable level, the bird strike hazard to USAF aircraft.

Efforts under this program will include upgrading the test and data acquisition capability of an air gun test facility, validation of an available math model for large bird impact, study of bird attitude effects on impact loads and investigation and validation of a substitute bird material to be used in impact testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, BROADBANK JET NOISE AMPLIFICATION BY A PURE TONE EXCITATION
P.J. Morris, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Aerospace Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NSG 1580)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0022, STUDY TO DETERMINE THE VALIDITY OF BIOLOGICAL BOMB DETECTION
Unknown, U.S. Veterans Admin., Dept. of Medicine & Surgery, Medical Center, *38th & Woodland Aves., Philadelphia, Pennsylvania* 19104 (FA78WAI-854; FA161221 (TRAIS NO.))

The objectives of this program are to determine sustained performance characteristics of gerbils and domestic rats in olfactory discrimination; the best training method to develop the animals for placement in an explosive detection system; and the effective repertoire of odors that these animals can be trained to detect. The design of this research should be consistent with the goal to employ these animals at airports to detect a variety of explosives either carried by persons or in baggage.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0023, DETERMINE LOADING BEHAVIOR OF MK7-1 AND MK7-2 ARRESTING GEAR
R.S. Ebers, L T V Aerospace Corp., Vought Systems Division, *P.O. Box 5907, Dallas, Texas* 75222 (DN590025; N00019-75-C-0237)

Perform a study to determine the characteristic loading behavior of the MK7-1 and MK7-2 arresting gear by analysis of airplane test data.

The approach will consist of data gathering and data analysis to establish optimum characteristics for loading behavior of the arresting gear.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0024, SCALE MODELS FOR THE IMPROVEMENT OF FLOW PATTERNS OF A LOW-SPEED TUNNEL
P.S. Barna, Old Dominion University, School of Engineering, Dept. of Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NSG 1563)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0025, HT SS 78-35 - AAH (BELL) CRASHWORTHINESS TESTS
L.T. Burrows, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3820)

To determine the degree that industry can design and fabricate an aircraft to the criteria of TR 71-22, i.e., MIL STD 1290.

Crash-test the Bell AAH against the criteria of the 95th percentile crash and through extensive instrumentation measure force attenuation to occupants. Program will be initiated in the 4th quarter FY78 after delivery of the aircraft to this laboratory. Following other tests, the aircraft will be drop-tested to destruction.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0026, INVESTIGATION OF COUPLED TORSIONAL-AXIAL-LATERAL COUPLED RESPONSE OF GEARED SYSTEMS
L.D. Mitchell, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Mechanical Engineering, *Blacksburg, Virginia* 24061 (NSG 3239)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0027, AIR CYCLE MACHINE LIFE OPTIMIZATION
A. Lloyd, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF141160; F33615-78-C-3407)

This work unit supports the on-going program to develop a closed-loop environmental control system utilizing a shaft powered positive displacement air cycle machine within the loop. Positive displacement air cycle machine's performance and life can be increased through improved design of lubrication, materials, bearings, and seals. The objective of this work unit is to optimize components and elements of the air cycle machine which most effect life and mean-time-between-failures (MTBF). The result will be a significant improvement in the life-cycle cost associated with aircraft environmental control systems with a four-fold increase in MTBF over conventional air cycle machines.

Develop designs for bearings, vanes and lubrication components for the positive displacement air cycle machine. Bench-test such components to evaluate life and durability characteristics. Incorporate promising component designs into a complete air cycle machine (ACM) and test to determine performance and failure/life data base.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, RADIATION SURVIVABILITY OF SATELLITE COMPONENTS

J.C. Ritter, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880086)

The objective of this work is to increase the level of survivability of spacecraft components in combined nuclear and natural radiation environments. This work has direct applications to the hardening of Navy satellite systems to meet the JCS nuclear hardening guidelines.

The approach is to investigate the use of multiple-element x-ray shields to minimize the dose deposited in satellite components per unit shielding mass. Initially secondary photons and particles will be neglected, but they will be included in later calculations. Optimal combinations of elements will be selected for x-ray shielding. Other radiation environments such as natural and weapon injected electrons, trapped and solar flare protons, etc, will then be included for selected orbital parameters. The studies will include spacecraft orbit-dependent radiation environments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

2.0002, SPACE TRANSPORTATION SYSTEM

J.A. Sholtis, U.S. Dept. of Defense, Air Force, Weapons Lab., *Kirtland Air Force Base, Albuquerque, New Mexico* 87117 (DF194360)

To provide technical nuclear safety support to HQ USAF and, in particular, the DOD Interagency Nuclear Safety Review Panel (INSRP) coordinator for the formal nuclear safety evaluations of the Space Transportation System (STS) and the proposed NASA Jupiter Orbiter Probe (JOP) or Galileo spacecraft/mission, IAW AFT 122-15.

This effort will involve many and varied tasks, including: technical meeting support, document evaluation, performance of technical studies or analysis, performance independent nuclear safety/risk evaluation of the Galileo mission, which will be presented to the INSRP for consideration and review. An AFWL technical report will not be processed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, CRYSTAL STRUCTURE OF HIGH-TEMPERATURE MATERIALS

R.N. Anderson, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Materials Sciences, *Washington Sq., San Jose, California* 95192 (NSG 2329)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0002, ANTIREFLECTION COATINGS FOR SOLAR CELLS

K.S. SreeHorsha, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Materials Science, *Washington Sq., San Jose, California* 95192 (NSG 2355)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0003, ENVIRONMENTAL STABILITY OF COMPOSITE RESIN MATRICES

A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NSG 2353)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0004, THERMAL PROTECTION COATINGS

L.A. Mayer, California State University & Colleges, San Jose State University, School of Chemistry, *Washington Sq., San Jose, California* 95192 (NSG 2340)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0005, UV FIBER OPTICS INTEGRATION STUDY

R. McGunigle, H T L Industries Inc., *Santa Ana, California* (DF462810; F33615-78-C-2030)

To determine the potential application of UV fiber optics for use with the advanced aircraft fire detection system currently under development under WU 23480102.

An in-depth study and analysis of current UV fiber optics technology will be conducted to determine application to current detector system development in terms of cost reduction and improvement in reliability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0006, ADSORPTION OF BIOMONOMERS ON SELECTED TRANSITION METAL CLAYS

M.A. Sweeney, University of Santa Clara, Graduate School, Dept. of Chemistry, *Santa Clara, California* 95053 (NCA 2-685903)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0007, UTILIZATION OF ALCOHOLS AS ALTERNATE TRANSPORTATION FUELS

R.K. Pefley, University of Santa Clara, School of Engineering, Dept. of Mech Engin, *Santa Clara, California* 95053 (EC-78-C-03-1737)

Alcohols are being studied as alternatives to petroleum fuels for transportation. Dynamometer mounted engines are being characterized with petroleum fuels then modified and comparatively tested with alcohols in terms of performance and emissions. Computerized combustion kinetic studies are being used to guide further engine modifications. Vehicles have now been operated on public streets on neat methanol for seven years. A five-car fleet of vehicles is expected to be operational in the fall of 1978. Comparative smog chamber studies are under way contrasting the

photochemical reactive of emissions from gasoline-powered automobiles to alcohol-powered automobiles. Comparative alcohol and jet engine fuel studies are also being conducted.

BIBLIOGRAPHIC REFERENCES: Pefley, et al., Characterization and Research Investigation of Methanol and Methyl Fuels, Final report, EPA Grant No. R803548-01, ME77-1, Aug. 77.

SUPPORTED BY U.S. Dept. of Energy

3.0008, CHARACTERIZATION OF PETROLEUM

J.S. Ball, U.S. Dept. of Energy, Div. of Petroleum & Natural Gas, *Washington, District of Columbia* 22203

The objectives of this project are measurement of appropriate thermodynamic properties of organic compounds; analysis of the quality of gasoline, aviation and diesel fuels, and burner fuel oils; development of analytical methods for separating heavy ends of crude oils, removing acids, bases, and nitrogen compounds and separating heavy paraffins from aromatics; analysis of asphalts to predict durability as roadbuilding material; and determination of chemical and physical properties by the Bureau of Mines.

SUPPORTED BY U.S. Dept. of Energy

3.0009, PHASE TRANSITIONS EXPERIMENT AT VERY HIGH PRESSURE

Unknown, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NSG 7496)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0010, PRODUCTION OF SPECIFIC ANTIBODY WITHOUT SPECIFIC IMMUNIZATION - EXTENSION TO CLINICALLY IMPORTANT ANTIGENS

R.A. Goldsby, University of Maryland, College Park Campus, School of Agriculture, Dept. of Chemistry, *College Park, Maryland* 20742 (NCA 2-420901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0011, COLLOQUIUM ON THE LIMITS OF LIFE

C. Ponnamperuma, University of Maryland, College Park Campus, School of Agriculture, Dept. of Chemistry, *College Park, Maryland* 20742 (NSG 7469)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0012, STABILIZATION AND GRAPHITIZATION OF ACRYLIC FIBERS AND CARBON COMPOSITE MATRICES

D.R. Uhlmann, Massachusetts Inst. of Technology, School of Engineering, Dept. of Metallurgy & Materials Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF049980; AF-AFOSR-3466-77)

AF function - advanced strategic missile systems will utilize carbon-carbon structural composite materials for nozzles and nosetips. Deficiency - the fundamental process chemistry of carbon fibers and carbon fiber-carbon matrix systems and the effect on ultimate properties are not understood. Objective - the objective of this research is to systematically study how process variables influence the chemical reactions and structural changes which take place in the conversion of acrylic fibers to carbon fibers and the influence of the fibers on the composite matrix mesophase precursor. How work contributes - this research will contribute to the establishment of the process science base essential to meeting the requirements of propulsion and reentry grade carbon fibers and composites.

Research will focus on (1) the tension, time and temperature conditions and concentration of the oxidizer in the atmosphere during the various stages of oxidative stabilization of acrylic fibers and the effect on chemical and physical structure; (2) the translation of the structural features of the stabilized fibers through the firing step into the final carbon fibers, the influence of the carbonizing temperature range on the stabilized fiber structures, and the extent to which stabilization orientation is reflected in the carbon fiber properties; (3) the influence of the fiber structural and surface chemistry on the composite matrix precursor, fiber-matrix interface, and graphite matrix; (4) the development and testing of models to describe these phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0013, ULTRA PRESSURE MATERIALS SCIENCE RESEARCH WORK

Unknown, Cornell University, Ithaca Campus, Graduate School, *101 Sage Graduate Ctr., Ithaca, New York* 14850 (NSG 7488)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0014, FAILURE PREDICTION IN GLASS 14889-MS

R.H. Doremus, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Materials Engineering, *110 8th St., Troy, New York* 12181 (DA0F9271; DAAG29-78-G-0141)

To establish the functional dependence of failure time of glass upon externally applied stress. Relevance - the research is relevant to the static fatigue (failure of brittle materials which have been subjected to a constant load less than their modulus of rupture) of ceramics and glasses. Ceramics and glasses are subjected to conditions in service which could lead to fracture, e.g., ceramic radomes, ceramic armor, fiber optics, glass fibers in composites (helicopter rotor blades).

Measurement of delayed failure and failure at different loading rates (tau on the order of 0.01 2 to 1000000 sec) over a wide range of stress and derivation of equations for loading rate experiments from various relations between crack velocity and stress.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0015, STATIC AEROELASTIC ANALYSIS INCLUDING CHORDWISE BENDING

E. Deska, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881676)

Development of a methodology to account for chordwise bending in static aeroelastic analysis.

Existing techniques which develop aerodynamic and structural influence coefficients will be modified to provide the additional degrees of freedom which will account for the effects of chordwise bending.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

3.0016, FRACTURE TESTING OF GRAPHITE/POLYIMIDE

D.H. Morris, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science & Mechanics, *Blacksburg, Virginia* 24061 (NSG 1571)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0017, SPACE ENVIRONMENTAL EFFECTS ON ADVANCED COMPOSITES

R.C. Tennyson, University of Toronto, *92 College St., Toronto, Ontario, Canada* M5S 1B2 (DF053280; AFOSR-78-3694)

AF function - large space structures will be of major significance to the Air Force with the operational capability of the space transportation system (STS). Opportunity - the influence of the space environment on the mechanical and thermal properties

of advance composite structural materials is largely unknown. This research will provide a unique opportunity to investigate these conditions. Objective - to identify the influence of simulated and in-site space environmental conditions on the mechanical characteristics of advanced composite materials in real time and to evaluate accelerated environmental exposure techniques. How work contributes - results will contribute to the development of large space structures for the Air Force.

Tubular test specimens fabricated from graphite-epoxy prepreg tapes will be used in the experimental research. Both lay-up angles for symmetric laminates and ply thickness will be varied during the experiments to be conducted. Experiments will be conducted at both ambient and simulated space conditions. Space simulated conditions will be at 10 to the 7th power torr and from minus 200 F to plus 250 F. Thermal coefficients of expansion (CTE), internal stresses and outgassing products will be measured under steady state exposure and thermal cycling. In addition, stress-strain behavior, strength and fracture toughness will be determined as a function of exposure conditions. Accelerated environmental exposure techniques will also be investigated. Finally, comparisions will be made between the experimental results obtained as a result of ground space simulation and results from specimens used on NASA Long Duration Exposure Facility (LDEF).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, DEVELOPMENT OF BASIC THEORIES AND TECHNIQUES FOR DETERMINING STRESSES IN ROTATING TURBINE OR COMPRESSOR BLADES
W.F. Swinson, Auburn University, School of Engineering, Dept. of Mechanical Engineering, *Auburn, Alabama* 36830 (NSG 3233)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0002, OBSERVATIONS OF BARIUM JETS FROM PORCUPINE III AND IV ROCKET LAUNCHES
T.J. Hallinan, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (NSG 6024)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0003, FEASIBILITY STUDY FOR A LOW-COST RAM-JET FUEL CONTROL
D.J. Schaffer, Signal Companies Inc., Airesearch Manufacturing Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DN890121; N00019-78-C-0413)

Conduct a research project to prove feasibility of a fluidic fuel control concept which can be applied to an advanced ram-jet engine.

The approach is to define the control system and its component parts and determine the critical interfaces with the proposed ram-jet and the vehicle. A preliminary layout of the control system to include all sensor inputs will be made and the critical items will be fabricated and bench-tested to cover the predicted operation parameters in order to prove operational capability of the fuel control.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0004, RESEARCH IN TURBOMACHINE ROTO FORCES
A.J. Costa, California Inst. of Technology, Graduate School, *1201 E. California Blvd., Pasadena, California* 91109 (NAS 8-33108)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0005, SUMMER FACULTY FELLOWSHIP PROGRAM
Unknown, California Inst. of Technology, Graduate School, *1201 E. California Blvd., Pasadena, California* 91109 (NGT 05-003-790)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0006, ROTOR SYSTEM RESEARCH AIRCRAFT - MATHEMATICAL MODELLING, STATE ESTIMATION, AND PARAMETER IDENTIFICATION
J.C. Wang, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCA 2-675902)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0007, GROWTH OF GALLIUM ARSENIDE
W.P. Allred, Crystal Specialties Inc., *Monrovia, California* 91016 (DF901130; F19628-76-C-0118)

AF function - radar communications and ECM systems which require gallium arsenide microwave devices. Deficiency - gallium arsenide microwave devices lack reliability and reproducibility due in part to the poor quality of commercially available gallium arsenide substrates. Objective - to grow improved quality gallium arsenide bulk crystals. How research contributes - this research should provide a technique to grow improved quality gallium arsenide crystals for use as substrates for gallium arsenide microwave devices. It is expected that such devices will have higher reliability and reproducibility.

The approach to this work will be divided into three areas: 1) To construct a liquid-seal Czochralski crystal puller. 2) To use the crystal puller to grow high-quality single crystals of undoped gallium arsenide using various crucible materials which will include quartz, boron nitride, aluminum oxide, carbon, and aluminum nitride (if available). These crystals will be submitted to AFCRL/LQP for evaluation. 3) To grow single crystals of gallium arsenide which are intentionally doped with known impurities at known levels to produce n-type, p-type and semi-insulating electrical properties.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0008, MECHANICAL PROPERTIES OF ADVANCED FABRIC MATERIALS
C.W. Baytes, Stanford University, Graduate School, *Stanford, California* 94305 (NSG 2346)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0009, CRYOGENIC HE3 NUCLEAR GYRO
D.B. Debra, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (DF052880; F49620-78-C-0088)

AF function - self-contained, high-precision navigation systems are of prime military importance in air and space flight and weapons systems. Opportunity - results in atomic physics and cryogenic technology suggest the use of particle spins as gyroscopic reference with a potential for very high-accuracy guidance systems realizations at reduced costs. Objective - demonstrate the feasibility and the limitations of a cryogenic nuclear magnetic resonance gyroscope as precision angle and angular rate reference, followed by an assessment of the potential of its combination with a cryogenic gravity-gradiometer. How work contributes - will lead to a new guidance system which employs local

vertical tracking and complements or improves conventional inertial guidance systems.

Polarized He3 nuclei, cooled to 4.2 k will be caused to precess at right angles to a small constant magnetic field and the precessing signal observed. Use is made of experience already obtained in techniques for polarizing He3 by optical pumping, obtaining long nuclear relaxation times, obtaining very low homogeneous and stable magnetic fields inside superconducting shields, fabricating and testing quartz gyro housings and using SQUID magnetometry for gyro readout. The first part of the effort will concentrate on construction and testing of the instrument, which is to render data for its evaluation as a candidate for an all-cryogenic inertial measuring unit together with cryogenic gradity gradiometers and accelerometers already under development under AFOSR sponsorship.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, THE VALUE OF DYNAMIC FRACTURE TOUGHNESS AND ITS DEPENDENCE ON MATERIAL PROPERTIES AND LOADING CONDITIONS 14932-E

G. Herrmann, Stanford University, School of Engineering, Dept. of Applied Mechanics, *Stanford, California* 94305 (DA0F9195; DAAG29-78-G-0086)

To develop a direct and reliable method for the evaluation of the dynamic fracture toughness coefficient during fast crack propagation. Relevance - the results of this study will be important for the analysis of high-strength materials under dynamic flight conditions such as in the Viper and BMD interceptors, as well as for crash-resistant structures.

The problem will be modelled by a boundary value problem and solved using a two-dimensional Lagrangian, finite-difference wave propagation code.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0011, ADAPTIVE ANTENNA ARRAYS FOR AIRCRAFT COMMUNICATIONS

B. Widow, Stanford University, School of Engineering, Dept. of Electrical Engin, *Stanford, California* 94305 (DN890084; N00019-78-C-0276)

Novel adaptive techniques for processing antenna array signals will be investigated. The overall objective is to develop and determine the usefulness of several schemes for separating incoming signals by power level, spectral characteristics, angle of incidence, etc., to demodulate and identify such signals and to do this with a sparse and irregular receiving array.

Emphasis will be directed toward the investigation of a 'leaky' least mean square (LMS) algorithm. The leaky LMS algorithm appears to offer unique advantages for achieving antenna adaption under conditions where the antenna elements change their spacing due to antenna movement such as occurs for elements mounted on aircraft wings. The leaky LMS algorithm will be studied to determine stability, rate of learning, misadjustment, and demodulation distortion in the presence of broadband noise and narrowband signal inputs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0012, VALIDATION OF AIR QUALITY ASSESSMENT MODEL FOR NAVAL AIR OPERATIONS

D.W. Netzer, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* (DN898054)

(A) Experimentally determine the effects of vehicle velocity, jet turbulence intensity, and ambient turbulence intensity on jet dispersion rates. Incorporate data for sigma sub y and sigma sub z and plume rise into AQAM as required. (B) Assist NAPC or their designates in becoming operationally familiar with AQAM for naval air operations.

All basic experimental equipment (wind-tunnel modifications, thermocouple rake, hot wire, etc.) will have been constructed in FY 78. The remaining tasks will be to incorporate means for providing realistic variations in the turbulence intensity profiles and a translating jet exhaust. (A) Modify jet apparatus (which can be translated in the vertical direction) to allow for acceleration along the simulated runway. (B) Incorporate boundary layer trips and free stream grids to simulate realistic variations in the ambient turbulence intensity and scale. (C) Use FY 78 data together with new data for final update of AQAM dispersion routine.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

4.0013, SUMMER FACULTY FELLOWSHIP PROGRAM

Unknown, University of Santa Clara, Graduate School, *Santa Clara, California* 95053 (NGT 05-017-998)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0014, TURBINE END WALL TWO-CYLINDER PROGRAM

L.S. Langston, University of Connecticut, Storrs Campus, Graduate School, *Storrs, Connecticut* 06268 (NSG 3238)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0015, CRITICAL REVIEW OF RECENT RUSSIAN SCIENTIFIC LITERATURE ON FLOW SEPARATION

P.K. Chang, Catholic University of America, School of Engineering & Architecture, Dept. of Civil & Mechanical Engineering, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (DF052660; AFOSR-78-3636)

AF function - advanced aerospace vehicles. Deficiency - lack of basic knowledge about various aspects of flow separation on general flight vehicle configurations across the speed regime. Objective - to evaluate recent Russian contributions to the field of flow separation and to disseminate this information to the U.S. scientific community. How work contributes - by evaluating the original Russian contributions in the field of flow separation in light of research underway in the West and also by providing a means to disseminate the information, this work will help advance the state of knowledge, help eliminate unnecessary duplication of effort, and provide a firmer foundation for continuing research.

A critical review will be made of the most significant of the 300 recent Russian papers referenced in 'New Results of Separated Flow Studies,' NASA TTF 117, 130, as well as two books in process of being translated, 'Gradient and Separated Flows' (1976) edited by S.S. Kutateladze and 'Gas Dynamics of Near Wake' (1976) by A.I. Shvets and I.T. Shvets. These references will be evaluated in light of approaches followed and results obtained by Western researchers working in related areas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0016, DRAG REDUCTION

J.M. McMichael, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20234 (2130486)

OBJECTIVE: To determine the merits of the compliant surface as an effective method for achieving drag reduction in air and water.

APPROACH: The investigation in air will be conducted on a specially designed flat plate in the 5-foot by 7-foot test section of the NBS dual-test section wind tunnel. Similarly, a test surface will also be installed in the new water tunnel due to be delivered in January 1978. The drag characteristics of several types of compliant surfaces will be examined and compared with a rigid reference surface. Pertinent parameters such as overall skin-friction drag, tensions in the surface, thickness of substrate, boundary layer thickness and free-stream velocity will be reliably controlled and accurately specified.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

4.0017, ATMOSPHERIC RADIATIVE TRANSFER AND ATOMIC PROCESSES

A.E. Green, State University System of Florida, University of Florida, School of Engineering, Dept. of Aerospace Engineering, *220 Black Hall, Gainesville, Florida* 32611 (ATM75-21962 A03)

This grant will fund research into a variety of problems. These include: 1. Theoretical atmospheric radiative transfer calculations. These calculations deal with multiple scattering processes in a variety of environments including a partially obscured sky. 2. Experimental atmospheric radiative transfer measurements. These measurements will be used to check the validity and accuracy of the radiative transfer calculations. Few measurements of this type have been made in the past. These relatively simple measurements should enhance our knowledge of the intensity of ultraviolet radiation in the lower atmosphere. 3. Atomic calculations for aeronautical applications. This work will continue the calculation and the 'cataloging' of electron collision cross sections of aeronomic interest.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

4.0018, POSTDOCTORAL PROGRAM

T.B. Senior, Purdue University, Graduate School, *Executive Bldg., West Lafayette, Indiana* 47907 (DF911760; F30602-75-C-0082)

The objective of this effort is to use measured and computed data from cruise missiles to develop probability of detection curves, Swerling models, and discrimination algorithms useful for a space-borne radar system. To provide static data for other contractors who will provide a dynamic data for system evaluations.

Model measurement and computed data will be taken at the University of Michigan. These data will be analyzed to provide the patterns and curves needed for system inputs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0019, ANALYSIS AND SIMULATION OF WIND ENERGY SYSTEMS

P.C. Krause, Purdue University, School of Engineering, Dept. of Electrical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (NSG 3237)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0020, VIDEO IMAGE COMPRESSION USING VELOCITY PREDICTION

N. Ahmed, Kansas State University, School of Engineering, Dept. of Electrical Engineering, *Anderson Hall, Manhattan, Kansas* 66502 (NCA 2-363801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0021, COMPLEX TURBULENT FLOWS

L.S. Kovasznay, Johns Hopkins University, School of Engineering, Dept. of Mechanics & Materials Science, *34th & Charles Sts., Baltimore, Maryland* 21218 (DF052330; AFOSR-78-3610)

AF function - advanced aerospace vehicles. Deficiency - there is little knowledge of the behavior of the freestream turbulence within interacting flow fields. Objective - develop understanding of turbulent shear flows where two streams with different turbulent structure interact. How work contributes - many real flow problems of interest to the AF involve the interaction of two fluid streams with different turbulence structure. These include ingestion of freestream turbulence within an external boundary layer, the interaction of exhaust gases with the vehicle wake flow, the mixing of combustion components within a combustion chamber, and the entrainment of freestream gases within jet ejectors. An understanding of behavior of these gas streams with different turbulence structure will aid better modeling of transition to turbulence criterion, separation behavior of base flows, noise creation by jet exhausts, decay criterion of wake flows and many other problems of practical interest.

An experimental investigation of the behavior of the large-scale structure of axisymmetrical flow streams when different turbulence structures are initially present within the interacting streams will be performed. The results of these interactions will be compared to existing prediction methods and new modeling methods will be proposed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, CONTINUUM ABSORPTION COEFFICIENT OF ATOMS AND IONS

B.A. Armaly, University of Missouri, Columbia Campus, School of Engineering, Dept. of Mechanical/Aerospace Engineering, *103 Engineering, Columbia, Missouri* 65201 (NSG 1581)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0023, THE EVALUATION OF CANDIDATE METALS IN A SIMULATED SPACE SHUTTLE MAIN ENGINE ENVIRONMENT FOR APPLICATION AS TURBINE BLADE DAMPERS

L.H. Caveny, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (NAS 8-33102)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0024, ASSESSMENT OF DATA BASE SEARCHING AND DOCUMENT DELIVERY VIA COMMUNICATIONS SATELLITE

R.G. Lerner, American Inst. of Physics Inc., *335 E. 45th St., New York, New York* 10017 (DSI77-18052)

The project is an experiment designed to evaluate remote search of STI abstracts and other bibliographic information combined with the delivery of full text of documents using a communication satellite and facsimile transmitters. The American Institute of Physics provides the physics and astronomy literature through the AIP SPIN data base from 1975 on, resident in the Lockheed DIALOG data base. Participating NASA scientists and engineers will access the data base via a satellite link from NASA Ames, Goddard, and Lewis. The Jet Propulsion Laboratory will be serviced by telephone line to Lockheed. Lockheed will transmit requests for materials identified as being of immediate interest to AIP in New York via telephone. In New York, AIP will initially transmit the required article in real time using a standard facsimile device to the requesting site. In the final quarter of the experiment, the facsimiles will be transmitted via a satellite line; additionally, AIP may provide the approved manuscript copy for video scanning or slow-scan TV transmission, with or without a facsimile copy.

SUPPORTED BY U.S. National Science Foundation, Div. of Science Information

4.0025, THEORETICAL STUDIES OF THREE-DIMENSIONAL TRANSONIC FLOW THROUGH A COMPRESSOR BLADE ROW

W.J. Rae, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF051940; F49620-78-C-0057)

AF function - advanced turbomachinery. Opportunity - improvement of present methods for predicting flow through an axial flow compressor. Objective - to develop a numerical method for calculating the inviscid three-dimensional flow field in a transonic compressor for cases in which the blades are highly loaded. How work contributes - will provide a basis for improving present empirical techniques used in designing advanced axial flow compressors and fans.

A capability now exists for calculating the three-dimensional flow through a row of compressor blades within the approximation of nonlinear small disturbance theory. In this program the full nonlinear potential equation will be solved. Techniques to handle

the boundaries (blade surfaces), periodicity and far-field conditions will be developed. Treatment of the vortex sheet contributions to the potential will also be devised. Finally, all these techniques will be incorporated into a procedure which will yield solutions for inviscid, three-dimensional, fully nonlinear potential flow through a highly loaded compressor blade row.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, VCASS HELMET-MOUNTED DISPLAY DESIGN
M. Shenker, Farrand Optical Co. Inc., *New York, New York* (DF323770; F33615-78-C-0512)

The objective of this program is to accomplish an optimized system design for an extremely wide field-of-view (FOV), virtual image, head-coupled display system for the Visually Coupled Airborne Systems Simulator (VCASS) program. This device will be utilized in conjunction with head and eye position sensing mechanisms and computer generated imagery subsystems to develop a wide FOV virtual scene simulator for engineering and training simulation applications.

The approach will be to develop a weighted matrix using appropriate analytical techniques which give in an engineering sense a figure of merit when related to the specified design criteria. When the matrix has been completed and design criteria are set a comprehensive study of potential design approaches will be made. The design approach which appears most promising will be selected for detailed analysis. Finally a detailed technical specification complete enough to allow fabrication of the design by any knowledgeable manufacturer of optics and display systems will be prepared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

4.0027, X-RAY DIFFRACTION, INTERFERENCE AND HOLOGRAPHY
N. George, University of Rochester, Graduate School, *Administration Bldg., Rochester, New York* 14627 (DF051510; AFOSR-78-3563)

AF function - non-destructive testing of structural members of aerospace vehicles could benefit greatly from the development of three-dimensional x-ray holography. Deficiency - holographic techniques are highly developed for electromagnetic radiation in the visible spectrum. X-ray holographic techniques, however, have not been developed and little, if any, research has been attempted to develop them. Objective - the objective of this research is to develop x-ray holographic techniques that can be utilized to evaluate nondestructively the interior of structural members of aerospace vehicles. How work contributes - this research could lead to the above objective.

Basic studies will be conducted in x-ray optics directed toward a critical evaluation of the feasibility of x-ray holography. The theory of partial coherence will be used to analyze interference methods for the characterizations of x-ray sources, including das Gupta's narrow line sources. Related studies of recoding media, microscopy, zone place imaging, speckle and photomixing will be performed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, MODELING OF TRANSIENT OPERATIONS OF MONOLITH CATALYTIC COMBUSTORS
J.S. Tien, Case Western Reserve University, Graduate School, Dept. of Fluid & Thermal Sciences, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (NSG 3230)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0029, MOMENTUM DISTRIBUTION OF IONS IN A PLASMA BEAM
O.K. Mawardi, Case Western Reserve University, School of Engineering, Dept. of Electrical Sci & Appl Physics, *University Cir., Cleveland, Ohio* 44106 (DF052090; AFOSR-78-3603)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of nonequilibrium plasma processes. Deficiency - the aforementioned information required for the design of advanced equipment is not available today. Its acquisition may be realized by a well-planned theoretical and experimental research program. Objective - this program will investigate the momentum distribution ions in a plasma beam. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

This program will perform experiments by using a specially designed analyzer to derive the distribution function of ions in a plasma beam. One may attempt to extract the electrons from the beam without affecting the momentum distribution of the ions. The aforementioned removal may be obtained by the use of a magnetic field. Preliminary measurements suggest that the mean temperature of the electrons is less than a few electron volts whereas the ions are relatively cold and have a directed velocity equivalent to 1 kev. Under these circumstances a magnetic field on the order of 100 gauss will represent an electron Larmor radius of a few centimeters and ion Larmor radius of many meters. Therefore one can extract the electrons and leave the ions untouched. The effect of collisions for the neutrals can be strongly minimized if the background pressure is below 10 microtorr. The experiments will obtain the ion momentum distribution of helium, argon and nitrogen. In addition the spatial distribution of the density in the beam will be checked with a holographic interferometer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0030, MECHANISM OF FIBER RELEASE DURING PYROLYSIS OF CARBON FIBER REINFORCED PLASTICS
E.E. Smith, Ohio State University, Columbus Campus, School of Engineering, Dept. of Chemical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NSG 3235)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0031, STUDY OF ENVIRONMENTAL SOLID PARTICLE EFFECTS ON AXIAL FLOW COMPRESSOR
W. Tabakoff, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (NSG 3218)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0032, NONLINEAR WAVE CHOKE INLETS
A.H. Nayfeh, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science, *Blacksburg, Virginia* 24061 (NSG 1573)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0033, DAIS EXECUTIVE SOFTWARE APPLICATIONS TO TRANSPORT NAVIGATION
D. Dewey, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF109830; F33615-77-C-1233)

To provide an independent contractor assessment of the DAIS executive software, industry exposure to the J-73 level one compiler and DAIS software development tools and a definition of the interface between DAIS and Integrated Navigation Systems. A combination of unique operational tactics, together with an available inexpensive ground map radar, TACAN,

OMEGA, INS and reliance on visual fix points, will be used to demonstrate the usefulness of the DAIS/Integrated Navigation System for tactical air drop and terminal area operations with transport aircraft.

Boeing Aerospace Lab simulation, jointly managed by AFAL and Boeing, will be conducted for the purposes of evaluating the DAIS/Integrated Navigation System software performance capabilities in a series of simulated tactical air drop and terminal area navigation flight profiles. This 'hot bench' simulation will be conducted using contractor-developed sensor software modules and navigation filter, and the DAIS executive software and processing hardware. Where available, actual sensors (i.e., IMU and OMEGA receiver) will also be used. AFAL will transfer the DAIS compiler, support software, and executive software along with two each GFE DAIS computers, bus control interface units (BCIUs) and console intelligence units (CIUs) to Boeing for the demonstration. The GFE hardware will be returned to AFAL upon completion of the demonstration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0034, AVIONICS/ENVIRONMENTAL CONTROL SYSTEM COMPUTER AIDED DESIGN

R. Johnson, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF141990; F33615-78-C-3417)

The quality of avionics thermal management affects equipment failures and life-cycle cost. Thermal management is accomplished external to equipment by aircraft environmental control systems (ECS) and internally by heat removal provisions. Multiple computer programs need to be interfaced for convenient, responsive analysis of the system aspects of thermal management. Design integration of avionics thermal management and aircraft ECS leading to optimization of reliability, performance penalties, and life-cycle cost of weapon systems is the objective of this effort.

Preliminary design of computer aided design (CAD) system architectures will be developed for avionics thermal design and aircraft ECS for convenient use by industry. Required optimization algorithms will be identified to address performance, reliability and costing parameters. A program plan will be developed to implement the CAD system design. CAD architecture walkthrough will be illustrated by a thermal design optimization and life-cycle cost payoff.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, DEVELOPMENT OF CAPABILITIES FOR COMPUTER PROCESSING OF REMOTELY SENSED DATA AT A MINORITY INSTITUTION

D.L. Montgomery, Alabama Agricultural & Mechanical University, School of Agriculture, Dept. of Natural Resource & Environmental Studies, *Normal, Alabama* 35762 (NSG 8066)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0002, DEVELOPMENT AND OPERATION OF A REMOTE SENSING DATA ACQUISITION PLATFORM FOR OCS STUDIES - R.U. 536

D.A. Laursen, University of Alaska, Central Office, U.S. Navy Naval Arctic Research Lab., *P.O. Box 509, Barrow, Alaska* 99723 (197 (NOAA/EAO No.))

PRIMARY OBJECTIVE: Meeting the objectives of OCSEAP scientists' remote sensing needs, as requested and coordinated through the OCSEAP Arctic Project Office in Fairbanks, will be the prime objective.

The primary objective will involve establishing, operating and maintaining aircraft remote sensing data collection platform capabilities. Secondarily, the data collected will be processed at the University of Alaska's Geophysical Institute to assist rapid turnaround of data for OCS scientists.

SUPPORTED BY U.S. Dept. of the Interior, Bureau of Land Management

5.0003, ARIZONA REGIONAL ECOLOGICAL TEST SITE (ARETS)

H.H. Schumann, U.S. Dept. of the Interior, Geological Survey, Water Resources Div, *Phoenix, Arizona* 85025 (AZ 71-026)

As world population continues to grow and increasingly greater demands are made on our resources, we must seek new methods to explore, discover, monitor, and manage the limited resources of the earth.

To provide assistance in the evaluation of air- and spaceborne remote sensor methods and applications to environmental and resources problems in Arizona. The project also has as a major objective to provide public access to remote sensing data housed at the EROS data center.

Visual interpretation and computer analysis of high-altitude aerial and spaceborne photography of Arizona is being conducted by USGS geologists, hydrologists, and geographers to develop remote sensing techniques. Preliminary evaluations by several state and federal user agencies in Arizona indicate a wide variety of potential and actual applications of high-altitude aerial and satellite photography to aid in the solution of Arizona's resources and environmental problems.

Access to remote sensor data housed at the EROS data center, and direct assistance in the use and evaluation of remote sensor data were provided to state, local, and federal agencies and to the public under the Arizona land use experiment. The State of Arizona and NASA have identified benefits in excess of 10 million dollars that have resulted from this experiment. Applications assistance function has been combined with a new NCIC state-level function. This function and the EROS data reference file have been transferred to the State of Arizona.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0004, LABORATORY STUDIES RELEVANT TO THE TITAN ATMOSPHERE

U. Fink, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (NSG 2349)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0005, STRATOSPHERIC AERONOMY

D.M. Hunten, University of Arizona, School of Liberal Arts, Dept. of Atmospheric Science, *Tucson, Arizona* 85721 (NSG 7485)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0006, APPLICATION OF REMOTE SENSING TECHNOLOGY IN NORTHERN CALIFORNIA

L. Fox, California State University & Colleges, Humbolt State University, School of Natural Resources, Dept. of Forestry, *Arcata, California* 95521 (NSG 2341)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0007, MAPPING VEGETATION UTILIZING REMOTE SENSING TECHNIQUES

L.E. Fox, California State University & Colleges, Humbolt State University, School of Natural Resources, McIntire Stennis Program, *Arcata, California* 95521 (0074360; CALZ00049)

OBJECTIVE: Prepare a vegetation cover map and determine changes in plant communities through time on the Hoopa Indian Reservation.

APPROACH: Use unprocessed LANDSAT data, determine the degree of PIXEL value similarity necessary to define a spectral class, classify the spectral data and describe the vegetation classes associated with the spectral class of 1973 and comparing them with those of 1977.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, California

5.0008, PLANETARY DYNAMOS

F.W. Busse, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Geophysics, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 7484)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0009, REMOTE SENSING OF PHYTOPLANKTON - REFLECTANCE SPECTROSCOPY OF MARINE BACTERIA AND COLLOIDS

D.A. Kiefer, University of Southern California, School of Letters Arts & Sciences, Dept. of Biological Sci, *3551 University Ave., Los Angeles, California* 90007 (7-717; 04-7-158-44123 MOD. NO.1)

OBJECTIVES: (1) To investigate the quantitative relationship between bacteria and colloids in the ocean and the spectral characteristics (color variations) of the water as seen from a space craft; and (2) to provide ship and scientific technical support during the Nimbus G/CZCS (Coastal Zone Color Scanner) post-launch experiment in February-March 1979.

APPROACH: (1) Current laboratory investigations into the relationship between changes in the diffuse spectral reflectance of the ocean and the presence of particles less than 1.0 micron in diameter (marine bacteria and colloids) will be extended by the use of reflectance spectroscopy. Specifically, the absorption and backscattering coefficients for common marine bacteria and isolated marine colloids will be determined from samples of southern California coastal waters. The bacteria will be concentrated using differential filtration techniques, whereas the colloids will be concentrated by ultra-filtration methods. (2) University of Southern California will provide a 110-foot research vessel, the R/V Velero IV, together with scientific/technical personnel, to conduct a 20-day cruise of southern California coastal waters. The measurements to be made, which include chlorophyll a and phaeophytin a concentration, sea temperature, and phytoplankton nutrients, are not only to provide surface truth during Nimbus G/CZCS overflights, but are to be used to extend the utility of the satellite data to times and places where surface truth is lacking. NESS scientists will be aboard to collect concurrent optical and particle size distribution data.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0010, REMOTE ATMOSPHERIC MEASUREMENTS USING LASER TECHNIQUES

S. Chiaoyao, Colorado State University, School of Natural Sciences, Dept. of Physics, *Fort Collins, Colorado* 80523 (DN880112; J.O. 55N03-30)

This contract will provide further development in (a) the single-particle correlated laser Doppler velocimeter (LDV) and (b) the laser time-of-flight velocimeter (LTV) for remote sensing of the atmosphere. Specific tasks are: (1) To conduct experiments for the evaluation of the concept and potential of the single particle correlation for remote wind speed sensing. (2) To develop techniques for overall aerosol concentration and size distribution measurements. (3) To develop a automated LDV and LTV systems for daytime use. (4) To investigate the possibility of obtaining new information on atmospheric turbulence in a short time scale of the order of milliseconds.

To extend the existing techniques of single-particle correlation LDV and the laser time-of-flight velocimeter at the Colorado State University for the simultaneous assessment of the wind speed and the aerosol concentration in the atmosphere. In situ particle sizing will be done by a two-angle intensity-ratio particle sizing spectrometer. Instrument development and evaluation, field experiments are to be emphasized.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0011, SUNSET METEOROLOGICAL RADAR

J.L. Green, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ42752)

PROJECT OBJECTIVE: To operate and further develop a large VHF pulse Doppler radar and other instruments at the Sunset field site in order to measure winds, waves and turbulence in the clear air, in the troposphere and lower stratosphere. To analyze these measurements in terms of tides, waves, turbulent transport, etc. in order to improve the understanding of the dynamics of the atmosphere.

CURRENT YEAR PLAN: Conduct observations of the dynamics of the lower atmosphere, including: the velocity structure of the jet stream, gravity waves, mountain lee waves, and stable layers. Analyze waves for energy and momentum transport and generating mechanism. Study convection driven turbulence. Deduce turbulent diffusion coefficient from measurements of turbulence and stability. Perform comparative experiments with aircraft, dropsondes and balloons. Study radar scattering mechanism. Study CAT dangerous to aircraft. Explore detection of tropopause by radar. Install 1 megawatt radar transmitter.

PROGRESS REPORT: Discovered and characterized specular radar echoes from stable atmospheric layers, modulation of turbulence by gravity waves. Estimated eddy dissipation rates from radar measurements, obtained wind velocity and turbulence parameters in and around thunderstorms. Compared radar and optical measurements of turbulence. Compared aircraft and radar measurements of turbulence. Measured fall velocity of hydrometeors relative vertical velocity of air. Installed microbarograph array near radar.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0012, ATLANTIC AND GULF STRUCTURES AND MOTIONS

D.V. Hansen, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs., *Boulder, Colorado* 80302 (83330119)

PROJECT OBJECTIVE: To increase knowledge and understanding of the kinematics and dynamics of current in selected deep and coastal oceanic regions as required for descriptive and predictive marine service of NOAA.

CURRENT YEAR PLAN: Research will continue primarily on deep ocean circulation processes. Work will focus on analysis of data previously collected from the Western Basin of the North Atlantic Ocean, the Gulf of Mexico, and the tropical Pacific Ocean, on new data collections in the Atlantic Ocean especially in regard to application of satellite data to oceanographic problems. Plans will be developed and preparation initiated for participation of the Global Weather Experiment of 1979 and related aspects of research into the role of the oceans in fluctuations of climate.

PROGRESS REPORT: Several new results were published on mesoscale motions in the North Atlantic and the Gulf Stream system. A special investigation was conducted of the effect of the severe winter of 1977 on the waters off the U.S. Atlantic coast. Data from the equatorial Indian Ocean have been analyzed and new data were collected by means of satellite-tracked free-drifting buoys as part of an investigation of the dynamics of equatorial current systems in relation to investigations to be conducted during the Global Weather Experiment and related research on climate.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0013, MEASUREMENTS OF ATMOSPHERIC TRACE GAS CONSTITUENTS OVER ANTARCTICA

D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics & Astronomy, *2115 S. University Blvd., Denver, Colorado* 80210 (DPP77-24304)

A spectrometer will be operated at South Pole Station during the austral summer of 1978/79 and 1979/80 to obtain high-resolution solar spectral data. From these, data will be obtained on the concentration of a number of important trace gas constituents over Antarctica.

Also an atmospheric emission spectrometer will be operated on the instrumented LC-130 aircraft during the austral summer of 1978/79 and 1979/80 to obtain data on the concentration and latitudinal variability of various trace gas constituents.

Logistics support is required for three persons during the Austral summers of 1978/79 and 1979/80.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0014, REMOTE SENSING OF LONG ISLAND SOUND

F.H. Ruggles, U.S. Dept. of the Interior, Geological Survey, Water Resources Division, *Hartford, Connecticut* 06103 (CT 71-027)

Long Island Sound is, has been, and will continue to be used as a source for salt-water based recreation and industry. The New England River Basins Commission has been directed to prepare a plan of study to restore and preserve the waters of the sound. As part of this plan formulation, the USGS is evaluating various hydrologic parameters, such as water movement and quality.

To evaluate data collected by remote sensing techniques as tools to measure hydrologic parameters such as sediment transport and tidal currents.

This is a continuing program to utilize NASA overflights at altitudes of 15,000, 25,000, and 50,000 ft to record dynamic hydrologic parameters via photography and infrared scanning. These data will be used together with some ground truth data to document present conditions and attempt to forecast changes that will be monitored by satellites.

Project completed. Reports published or in review.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0015, MEASUREMENT AND ANALYSIS OF SOLAR RADIATION IN FOREST STANDS - A NEW APPROACH

K.L. Reed, Yale University, School of Forestry & Environmental Studies, *205 Prospect St., New Haven, Connecticut* 06511 (ATM78-05675)

This project will characterize the vertical distribution of solar radiation in forest stands. The experimental approach consists of reversing the classical source/sensor relationship by placing radiation sources at different vertical levels within forest stands and assaying the radiation transmitted through the above lying canopies. The radiation emitted from these stands is then measured using a sensitive light detector carried on an aircraft. Data produced in this manner are independent of ambient light conditions and, therefore, reflect only the influence of forest structure and foliar biomass upon radiation transmission. By characterizing the radiation climate in forest stands and simultaneously correlating this to measured structural features and foliar biomass distribution, a method can be developed to accurately estimate insolation in forest stands based upon stand structure and measurements of incident direct and diffuse radiation.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0016, ANALYSIS OF SATELLITE PARTICLE OBSERVATIONS AND COINCIDENT AURORAL-E IONIZATION

J.R. Sharber, Florida Inst. of Technology, School of Science & Engineering, Dept. of Physics, *Country Club Rd., Melbourne, Florida* 32901 (DF052490; AFOSR-78-3625)

AF function - AF communication, detection and surveillance systems utilize paths through the ionosphere and their propagation characteristics are determined and perturbed by the state and fluctuations of the electron content of the polar ionosphere. Deficiency - at present, a determination of the total electron content of the polar ionosphere as a function of time and location and a forecast of its changes cannot be obtained from a knowledge of the plasma sheet particle population. Objective - to determine a quantitative relationship between spectral parameters of the plasma sheet particle population and routinely measured parameters of auroral-e layer ionization. Contribution - successful completion of this project will permit the determination of the approximate shape and total energy content of plasma sheet particle spectra solely from ionospheric soundings.

Data from two flights of the AFGL airborne ionospheric observatory will be coordinated with coincident measurements from ionospheric sounders at ground observatories and the satellites ISIS-2 and VELA. The data consists of - (1) Alaskan Chain Flight, Dec. 11, 1971 - to analyze the qualitative and quantitative relationship between particle spectra incident on top of the atmosphere and e-layer height and total energy content, (2) VELA Intersection Flight, Jan. 1974 - to compare particle spectra in the plasma sheet, particle spectra just above the auroral atmosphere and e-layer height and energy content.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0017, LABORATORY DETERMINATION OF INFRARED ABSORPTION LINE PARAMETERS FOR MOLECULES OF IMPORTANCE IN UPPER ATMOSPHERIC RESEARCH

R.H. Huni, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Physics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (NSG 7473)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0018, INFRARED FLUX IN THE EARTH'S ATMOSPHERE

L.D. Kaplan, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (ATM76-81027 A01)

The purpose of this research is to continue to develop methods for determining the three-dimensional distribution of flux of infrared radiation in the earth's atmosphere and its relation to the temperature, pressure, composition, cloud and snow cover, and aerosol fields. Emphasis will be placed on obtaining maximum computational speed compatible with the accuracy requirements of general circulation and numerical weather prediction models. The role of absorption of radiation by ozone, clouds, and aerosols in the tropospheric circulation will be investigated with special attention given to radiative effects on the thermal structure and dynamics during periods of a few days to a few weeks. Continued work on the determination of the characteristics of a remote sensing system to obtain high vertical resolution in retrievals of temperature and water vapor distributions will also be performed under this grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0019, EFFECT OF CONTRAIL CIRRUS ON SURFACE WEATHER CONDITIONS IN THE MIDWEST

S.A. Changnon, University of Illinois, Urbana Champaign Campus, School of Arts & Sciences, Dept. of Geography, *Urbana, Illinois* 61801 (ATM78-09568)

In many regions of the nation, jet aircraft traffic produces large numbers of persistent contrails which contribute to widespread cirrus cloud cover. This research seeks to determine whether contrail-produced clouds have led to measurable effects on surface radiation, sunshine and temperature in the Midwest. Two approaches are being used in this research. First, an analysis of midwestern historical data of temperature, radiation, sunshine soundings, sky cover, and cloud types, coupled with flight and

contrail data. This analysis emphasizes the magnitude and frequency of contrail-produced cirrus and its impact on surface temperature conditions. A second approach focuses on recent case study days when contrail cirrus were developed over wide areas of the Midwest. Days are selected on the basis of data availability including surface cloud camera photographs, specialized satellite observations and in-flight aircraft data.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0020, EFFECTS OF MINING AND LAND RECLAMATION ON HYDROLOGY OF SOUTHEASTERN KANSAS

A.M. Diaz, U.S. Dept. of the Interior, Geological Survey, Water Resources Division, *Lawrence, Kansas* 66044 (KS 77-081)

Effects of past and present mining of coal, lead, and zinc in southeastern Kansas has caused degradation of streams draining the mined areas. Quantitative measures of the degradation and identification of source areas are needed to assess the effectiveness of pollution-control measures, the possible need for changes in mining and reclamation procedures, and design of a long-term quality-monitoring network in southeastern Kansas.

The objectives of this project are to apply the extensive water-quality data being collected in Project KS 76-076 and remotely sensed data from aircraft and LANDSAT to (1) identification from computer-enhanced imagery of point-source areas where poor-quality water discharges from old shaft mines, strip pits, collapsed areas, spoil embankments, and reclaimed areas, (2) evaluation of land-reclamation effects on water quality by analyzing areal and temporal changes in vegetative vigor in reclaimed areas, (3) establishment of a continuing monitoring program using computer-enhanced imagery to detect anomalies associated with acid drainage, and (4) use of results from above activities to design an improved long-term water-quality-sampling network for the mining area in southeastern Kansas.

Remote-sensing techniques will be used to obtain data for analysis with signal-enhancement systems and digital densitometers to discriminate differences in water quality, degrees of vegetative vigor, and 'hot spots' in mined areas vs. natural areas. The analyses will aid identification of sources of stream-quality degradation related to drainage from shaft mines, stripped areas, collapsed underground workings, and coal-processing activities. Photography and imagery will be obtained repetitively from aircraft and, as appropriate, from LANDSAT for comparison to water-quality data from Project KS 76-076. Additional ground-truth data will be collected in anomolous areas identified from the remotely sensed data. Finally, the data will be used to design a long-term quality-monitoring network in southeastern Kansas.

Stream sites were selected for the acquisition of ground-truth data to be coordinated with the acquisition of remote sensing data. Specifications were written for preparation of a contract to be issued in FY 78, for acquisition of remote sensing data. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0021, QUANTUM MECHANICAL STUDIES OF THE SPECTRA OF MINERALS

Unknown, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NSG 7482)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0022, INFERENCE OF EFFECTIVE SOIL PROPERTIES FROM OBSERVED VEGETAL CANOPY DENSITY

P.S. Eagleson, Massachusetts Inst. of Technology, School of Engineering, Dept. of Civil Engineering, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 5306)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0023, FORECASTING QUANTITY AND TYPE OF PRECIPITATION

F. Sanders, Massachusetts Inst. of Technology, School of Science, Dept. of Meteorology, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (ATM78-15942)

This research addresses the problem of forecasting, with adequate skill, the type and quantity of precipitation accompanying synoptic disturbances in the Northeast. Current operational forecasts by the National Weather Service predict the field of motion and temperature with considerable skill; forecasts of moisture and precipitation are noticeably poorer for reasons not well understood. The present investigation will attempt to formulate the problem with precision using the MIT radar, existing observing stations of the National Weather Service, satellites, numerical forecasts, and possibly supplementary rawinsonde observations depending upon the results of proposed water budget studies.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0024, ULTRAVIOLET SURVEILLANCE BACKGROUND MEASUREMENTS

R.E. Huffman, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581300)

AF function - target detection, surveillance, attack assessment, tracking, communications. Deficiency - insufficient information concerning the spatial and spectral variability and magnitude of the global vacuum ultraviolet (VUV) radiation background. Objective -measurement with satellite sensors of the intensity of the VUV background, its spatial and spectral variation, and its correlation with ionospheric, solar, aeronomic, and auroral parameters. How research contributes - the background radiation from the earth's atmosphere must be known in detail for use with missile target intensities in the design and evaluation of new surveillance systems capabilities and for selecting optimum wavelength bands. Improvement in communications system operation will be possible following validation of indicated correlations of VUV radiation with ionospheric critical frequencies and auroral zone locations.

The global VUV radiation levels will be measured with the satellite experiment CRL-246 vacuum ultraviolet backgrounds. A spectrometer will provide resolution in the range 1050-3100 angstroms, and a photometer will provide spatial resolution comparable to systems resolution. The experiment will be flown on space test program flight S77-2.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, GLOBAL-SOLAR-TERRESTRIAL ELECTROSTATIC COUPLING

P.B. Hays, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Oceanic Sciences, *Ann Arbor, Michigan* 48104 (NSG 7492)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0026, THE INTERACTION OF A SPACECRAFT WITH ITS ENVIRONMENTAL SPACEPLASMA

U. Samir, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (ATM76-19790 A01)

This grant funds studies of the interaction of a spacecraft with the plasma environment, with the emphasis on the wake region behind the spacecraft. This is an important research areas which has received considerable theoretical attention, but where little effort has gone into experimental testing or verification of the theoretical ideas. There is increased interest in this subject at present because of proposals to use a wake shield with the shuttle spacecraft to produce an ultra-high vacuum. It may be that the electrical wake will be the limiting factor on the particle density in the region behind the wake shield.

Specifically, research under this grant will pursue two points: 1) Analysis of in situ-observations (from the AE-C/E satellites) in order to perform a phenomenological, parametric investigation, focusing on interaction dependences upon spacecraft velocity, diameter, and potential (measured in units of the ambient plasma parameters. 2) Comparisons between theory and experiment as well as between different theoretical models. Such studies should enhance our physical understanding regarding the nature and range of applicability of the assumptions (physical and mathematical) used in various wake/sheath theories.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0027, FOREST STAND MAPPING AND EVALUATION ON THE STATE AND PRIVATE LANDS IN MONTANA

F.L. Gerlach, University of Montana, School of Forestry, Mcintire Stennis Program, *Missoula, Montana* 59801 (0075184; MONZ07801)

OBJECTIVE: Determine the variability of forest stands delineated from high-altitude panchromatic aerial photography. Determine the accuracy with which ground conditions can be correlated to delineate stand classes. Determine the reliability of using the current Montana Forest Survey inventory data for assigning forest resource attributes to delineated stand classes.

APPROACH: Stands will be mapped from 176,000 panchromatic air photos, delineating stand height, canopy cover density, photo tone and texture, topographic exposure, watershed stream order, slope angle and position, and elevation. Random sample points will be selected, visited and measured. Photo and ground data will be compared with Forest survey data.

PROGRESS:

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Montana

5.0028, APPLICATION AND DEMONSTRATION OF MULTISPECTRAL SCANNER (MSS) DIGITAL SYSTEM FOR ENVIRONMENTAL MONITORING

M. Dockter, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab., Remote Sensing Operations Br, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J620A-43)

OBJECTIVE/APPROACH: Determine feasibility and demonstrate application of aerial multispectral scanning (MSS) for remote sensing of sediment in water, description of land use relationships, and silviculture/agriculture nonpoint sources of pollution; optimize aerial thermal infrared scanner survey techniques. The approach is through collection of surface and airborne MSS data to study atmospheric attenuation corrections and site-to-site algorithm transferability, and analyze results compared to EPA standard laboratory testing methods.

FINAL OUTPUT: Report describing results and feasibility of using remote multispectral techniques for EPA monitoring and regulatory purposes.

RESULTS TO DATE: Feasibility of airborne MSS system utility for environmental monitoring purposes has been established, and a field applications demonstration of a satellite scanner for an EPA coastal zone study has been completed.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0029, ASSESSMENT OF GEOPHYSICAL ALGORITHMS AND REGIONAL APPLICATION OF DATA (SEASAT-1)

V.E. Delnore, Rutgers the State University of New Jersey, New Brunswick Campus, Graduate School, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (NSG 1566)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0030, APPLICATION OF INFRASOUND AND GRAVITY WAVES TO THE STUDY OF THE ATMOSPHERE

W. Donn, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (ATM78-06771)

This grant funds research involving a novel atmospheric diagnostic technique: infrasound (sound waves of frequency too low to be audible to the human ear). Infrasound generated by the sonic boom from inbound Concorde supersonic transports is recorded at Palisades New York. Refraction effects on this received infrasound, arriving from distances of 150-1000 km, are determined by temperature and wind conditions in the stratosphere (40-50 km altitude) and lower thermosphere (100-130 km). The sonic boom can thus be used to provide temperature-wind information about these two altitudes from which the infrasound reflects. Daily observations show significant variations in these parameters. Natural infrasound of about a 5 second period is also radiated from the sea surface in regions of interfering ocean waves. Infrasound from this source also depends on the atmospheric temperature-wind field near the altitudes of reflection. This offers time continuous information about stratospheric and thermospheric temperature-wind fields. Application to the stratojet and poorly understood stratospheric warnings are prominent potential applications.

The observational technique is well established; this grant funds a pilot program to explore the degree to which these exciting potentials may in fact be realized.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0031, NAVY ENVIRONMENT - SATELLITE ALTIMETRY

A. Gordon, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (DN875360; N00014-75-C-0210)

Remote sensing by satellite altimetry from SEASAT may offer a technique of determining the position of ocean tides, fronts, or eddies from the relative heights of the ocean surface. This technique is exploratory and depends on the accurate removal of gradetic features and resolution of the residual signature.

SEASAT A altimetry data from the northwest Atlantic will be collected and the calculated geared signature removed. The residual data will be analyzed for physical oceanographic features relating to frontal and eddy positions. The resulting analysis will be compared to surface measurements for ground truthing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0032, ASTROPHYSICAL MATERIALS SCIENCE THEORY

Unknown, Cornell University, Ithaca Campus, Graduate School, *101 Sage Graduate Ctr., Ithaca, New York* 14850 (NSG 7487)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0033, AIRCRAFT OPERATIONS

R. Garber, U.S. Dept. of Energy, Brookhaven National Lab., *Upton, New York* 11973 (2355)

Approximately one-half of the aircraft's scheduled flight time will be utilized to conduct routine MAP3S observations, including horizontal and vertical atmospheric pollutant profiles and regional pollution transport studies. About one quarter of its scheduled flight time will be utilized for plume studies which are part of MAP3S. The remaining scheduled flight time will be used in cooperative atmospheric studies with aircraft and ground observation teams in conjunction with organizations outside BNL, but which are part of the overall MAP3S program.

SUPPORTED BY U.S. Dept. of Energy, Div. of Biomedical & Environmental Research

5.0034, INVESTIGATION OF INFRARED SPECTRA OF ATMOSPHERIC GASES TO SUPPORT STRATOSPHERIC SPECTROSCOPIC OBSERVATIONS

J.H. Shaw, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave., Columbus, Ohio* 43210 (NSG 7479)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0035, ANALYSES OF THE SURFACE HEAT BALANCE OVER THE WORLD OCEAN

S. Esbensen, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Atmospheric Science, *126 Agricultural Hall, Corvallis, Oregon* 97331 (NSG 5308)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0036, INTERNATIONAL SOUTHERN OCEAN STUDIES (ISOS) - SOUTHERN OCEANS LAGRANGIAN OBSERVATIONS

A.D. Kirwan, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Oceanography, *College Station, Texas* 77843 (OCE77-16825 A02)

International Southern Ocean Studies (ISOS) is a multi-institutional and international program which is focused on understanding the dynamics of the Antarctic Circumpolar Current. This project is an important part of ISOS and provides for a study of the survivability of satellite-interrogated surface buoys and the efficiency of their drogues.

An in situ study of buoy-drogue dynamics will be carried out in Massachusetts Bay. Two types of buoy hulls, a spar and a spar with an inverted cone flotation collar, and two types of drogues, a windowshade and a parachute, will be studied with emphasis on the overall survivability of the drogue and buoy. The results of this study will be used to choose a drogue for five spar buoys. These five spar buoys and drogues will be launched in the Circumpolar Current south of New Zealand during the austral summer, 1977-78. This buoy deployment will not only result in data on the survivability of buoys and drogues in the Southern Ocean, but will also provide information on the scales of ocean currents, sea surface temperatures, and sea-level barometric pressures of the Circumpolar Current. If this pilot deployment is successful, an expanded project would be proposed to study the Circumpolar Current between New Zealand and South America in 1979.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0037, CELLULAR BASES OF GRAVITY- AND LIGHT-INDUCED GEOTROPISM

Unknown, University of Texas, Austin Campus, Graduate School, *200 W. 21st, Austin, Texas* 78712 (NSG 7480)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0038, REMOTE SOUNDING IN CLOUDS

K. Liou, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF581650; F19628-78-C-0144)

AF function - weather forecasting, weapons delivery, surveillance. Deficiency - inability to determine meteorological temperature profiles under cloudy conditions. Objective - demonstrate enhancement of satellite sensed temperature profiles arising from microwave sounder in a cloudy atmosphere. How research develops - improves the ability to infer and forecast temperature profiles from satellite observations.

Calculation of radiative transfer of infrared and microwave energy through cloudy/precipitating atmospheres will be used as a data base to infer temperature profiles for realistic atmospheric conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0039, POLAR ICE REMOTE SENSING

W.J. Campbell, U.S. Dept. of the Interior, Geological Survey, Water Resources Division, *1305 Tacoma Ave. S., Tacoma, Washington* 98402 (WR 70-064)

One of the fastest varying large-scale features on the earth's surface is sea ice. Theoretical studies show that the ice canopy in polar regions to be of major importance in (1) determining the global heat balance, and (2) determining the vapor flux of water into temperate regions. In order to test the developing numerical models of polar regions it is necessary to acquire sequential large-scale synoptic data over polar regions. Remote sensing especially in frequencies in the microwave range, appear to offer the best chance of obtaining these data.

As Principal Investigator for Sea Ice for NASA and the Space Craft Oceanography Center-NOAA, we will design polar remote sensing experiments using NASA and other agency remote sensing aircraft and satellites. Aircraft and satellite experiments will be coordinated with necessary ground truth networks for the remote sensing systems. The basic premise for these plans will be to develop the correct remote sensing means to acquire data that will be useful in testing numerical models of sea ice and glacier ice.

Data obtained during the AIDJEX Main Experiment will be reduced and analyzed and applied to numerical models of the Beaufort Sea pack ice. Further Polar Ice Studies remote sensing flights are intended over targets in the Arctic. The Project Office will have experiments onboard Nimbus-G and SEASAT-A using both SMMR and SAR sensors to study any of several target areas to be chosen according to the orbits of the satellites. Work will continue on the SLAR imagery of the Alaska shear zone in order to obtain quantitative measurements of ice movement and deformation in the area. Progress is being made in setting up an imaging radar at Cape Mountain to monitor ice movement through the Bering Strait in a joint study with CRREL.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0040, STUDY OF THE PLANETARY BOUNDARY LAYER DURING THE JASIN EXPERIMENT, USING THE NCAR ELECTRA AIRCRAFT

J.A. Businger, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Science, *Seattle, Washington* 98105 (ATM77-14934)

The objective of this research is to analyze data collected from an aircraft platform during the Joint Air Sea Interaction Experiment (JASIN). JASIN will occur during the summer of 1978 in the North Atlantic area. The data will consist of air temperature, humidity, wind, long- and short-wave radiation and sea surface temperature. The goal is to use these data to gain a better understanding of convection in the atmospheric boundary layer. This work will be performed in concert with other field programs during JASIN, a regional subprogram of the Global Atmospheric Research Program (GARP). Specific results to be expected from this research include the distribution of momentum, heat and vapor fluxes near the air-ocean interface during disturbed and undisturbed weather conditions and the physical interpretation of those disturbances.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0041, HIGH-RESOLUTION SPECTROSCOPIC STUDIES IN AERONOMY

F.L. Roesler, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (ATM7720371A01)

This grant funds continued high-resolution spectroscopic studies of day and night airglow lines in the earth's atmosphere, and of weak absorption lines in the atmosphere of the earth and other planets. A combination of laboratory and field studies are aimed at improved determinations of the (D)/(H) ratio on Jupiter, Saturn and Uranus. The ratio is of cosmological importance, and provides information on the formation of the solar system and the structure of planetary atmospheres. Faint emission lines associated with Io, particularly of KI and SII lines, are also studied for information about the sources and interactions of the emitting atoms, and about the Jovian radiation belts. Geocoronal H alpha and H beta line profiles and intensities are to be measured in order to better understand the motions and excitation of geocoronal hydrogen atoms, and to remove uncertainties in geocoronal intensities determined by means of low-resolution spectrometers or photometers. Other day and night airglow lines should also be studied. Continued instrumented development is also to be pursued.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0042, TRANSFER OF INFRARED AND VISIBLE RADIATION THROUGH CLOUDS OF FINITE HORIZONTAL AND VERTICAL EXTENT 15227-GS

J.A. Weinman, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DA0F9223; DAAG29-78-G-0109)

To investigate the transfer of visible and infrared radiation through clouds of finite horizontal and vertical extent. Relevance -applicable to current research on obscuration by military smokes and natural clouds, and the interpretation of visible and infrared imagery from meteorological satellites. The research will provide a means to incorporate multiple scattering into the JTCG-MES-SEP obscuration model, the lack of which is the most serious shortcoming of the model.

Extend both a Monte Carlo and a fast analytical model partly developed to provide radiances in the visible region from isolated clouds, into the infrared region. Consideration also will be given to the intrinsic cloud properties such as extinction coefficient, single scatter albedo, and scattering phase function; and the effects of the underlying surface and the atmosphere in which the cloud is imbedded.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0043, DEVELOPMENT OF SECTORIZED ARCHIVE UNIT FOR SYNCHRONOUS METEOROLOGICAL SATELLITE DATA

V.E. Suomi, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Meteorology, *Agriculture Hall, Madison, Wisconsin* 53706 (ATM75-21048 A03)

The purpose of this grant is to provide support to complete the development of an archive unit that will be capable of providing Synchronous Meteorological Satellite (SMS) and Geostationary Operational Environmental Satellite (GOES) data to any user in a common computer compatible format at low cost. A special cassette records and magnetic tapes will serve as the major components of the archive.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0044, ANALYZING AND PROCESSING DATA FROM SAM 11/NIMBUS G AND SAGE/AGM-B SATELLITE

Unknown, University of Wyoming, Graduate School, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (NCA 1-19)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

5.0045, SOLAR RADIO PATROL/MANILA

V.L. Badillo, Manila Observatory, *Manila, Philippines* (DF582480; F19628-77-C-0200)

AF function - communications, surveillance and navigation. Deficiency - disruptions in communications systems due to solar-induced ionospheric disturbances. Lack of capability to predict interruptions to communications, false alarms in surveillance systems from natural causes, and navigation errors. Objective - to develop and interpret solar signatures of the onset of proton activity in the earth's atmosphere. How research contributes - makes reliable real-time information available to operational USAF groups. The primary purpose of this contract is to use data collected at Manila Observatory in solar-radio-optical, ionospheric and geomagnetic areas to interpret the time history of energetic particle emission.

Improve upon existing, and develop new, criteria for predicting the time history of energetic particle emission by addressing the magnetic field configuration and orientation of active regions as evidenced by optical and/or dekametric radio signatures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, AVIAN EMBRYONIC DEVELOPMENT IN HYPERDYNAMIC ENVIRONMENTS

A.H. Smith, University of California, Davis Campus, Graduate School, Dept. of Animal Physiology, *Davis, California* 95616 (NSG 7493)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0002, PALEOBIOLOGIC STUDIES OF ARCHEON EVOLUTION

Unknown, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 7489)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0003, SUSCEPTIBILITY TO INFECTION - INTERRELATIONSHIP OF INTERFERON AND GENETIC FACTORS

G. Sonnenfeld, University of Louisville, Graduate School, *2301 S. 3rd, Louisville, Kentucky* 40208 (NCA 2-400901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0004, ANGIOTENSION ANTAGONISTS AND VOLUME HOMEOSTASIS - STUDIES IN MAN, INTACT ANIMALS AND ISOLATED TISSUES

N.K. Hollenberg, Harvard University, Boston Campus, School of Medicine, Dept. of Radiology, *25 Shattuck St., Boston, Massachusetts* 02115 (NSG 9074)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0005, X-22A TASK V/STOL FLIGHT RESEARCH PROGRAM

J.L. Beilman, Calspan Corp., Aerodynamic Research, *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DN881490; N62269-78-C-0043)

To flight validate emerging new V/STOL flying qualities criteria with emphasis on the hover, low-speed and transition flight characteristics. This contract support work unit ZA601, Agency Accesion No DN6810809

This is a 2-year program divided into four subtasks each of which deals with a high priority segment of V/STOL flying qualities. Subtask A addresses hover, low-speed translational rate control flying qualities criteria in VFR flight. Flight experiments will be performed with turbulence control power and equivalent system form as elements of the experiment matrix. Pilot opinion ratings will be obtained results analyzed and a final technical report issued. Remaining subtasks will be defined pending results of Subtask A.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

6.0006, AN INVESTIGATION IN PILOT AND SYSTEM RESPONSE TO CRITICAL IN-FLIGHT EVENTS
T.H. Rockwell, Ohio State University, Columbus Campus, School of Engineering, Dept. of Industrial Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAS 2-10047)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0007, PAVE LOW CREW FATIGUE
P.J. Dowd, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324230)

The PAVE LOW III system was developed in response to MAC ROX 19-70 which established the requirement for a low level/adverse weather combat rescue mission. PAVE LOW III consists of a terrain following radar, forward-looking infrared (FLIR) sensor, inertial navigation system, Doppler radar set, and projected map display (PMD) integrated through a central avionics computer into a night recovery system equipped HH-53 helicopter. The results of DT & E and IOT & E indicated that the demands of the system coupled with the increased mission profile for which PAVE LOW was developed could impose high levels of fatigue and stress on the aircrew. The evaluation of crew fatigue and psychophysiologic stress during PAVE LOW missions will: (a) identify and analyze psychophysiologic stresses associated with the missions, (b) determine maximum flying time and crew duty day limitations, (c) determine predeparture and postmission crew rest requirements, (d) determine mimimum recovery period for repetitive missions, (e) evaluate crew performance, and (f) evaluate safety factors.

The SAM battery of psychophysiologic measures will be used, consisting of self-ratings of subjective fatigue, sleep surveys, oral temperature, and endocrine/metabolic indices derived from analysis of urine samples. These measures collected before and after each mission, also during nonflying intervals providing 3-4 days of baseline data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0008, DEVELOPMENT OF QUANTITATIVE EXERCISE PROGRAM FOR USE IN SPACE FLIGHT
A.E. Coleman, University of Houston, Graduate School, *3801 Cullen Blvd., Houston, Texas* 77004 (NAS 9-15642)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0009, LIGNIFICATION OF PLANT SEEDLINGS
Unknown, University of Houston, Graduate School, *3801 Cullen Blvd., Houston, Texas* 77004 (NAS 2-10087)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0010, DEVELOP BEHAVIORAL TESTS OF VESTIBULAR FUNCTIONING IN THE WISTAR RAT
H.C. Nielson, Utah Higher Education System, University of Utah, School of Social & Behavioral Sciences, Dept. of Psychology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (NSG 2350)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

6.0011, ALTERATIONS IN SKELETAL MUSCLE WITH DISUSE ATROPHY
R.H. Fitts, Marquette University, School of Liberal Arts, Dept. of Biology, *604 N. 16th St., Milwaukee, Wisconsin* 53233 (NAS 9-15711)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, STATISTICAL CLASSIFICATION TECHNIQUES FOR ENGINEERING AND CLIMATIC DATA SAMPLES
E.C. Temple, Alabama Agricultural & Mechanical University, School of Arts & Sciences, Dept. of Mathematics, *Normal, Alabama* 35762 (NSG 8065)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

7.0002, TRANSFORMATION OF TWO- AND THREE-DIMENSIONAL REGIONS BY ELLIPTIC SYSTEMS
J.F. Thompson, Mississippi State University, School of Engineering, Dept. of Aerophysics & Aerospace Engineering, *Suite 101 Engineering Bldg., Mississippi State, Mississippi* 39762 (NSG 1577)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

7.0003, AN INVESTIGATION OF SOFTWARE STRUCTURES FOR FULL AUTHORITY AVIONICS
C. Zanger, City University of New York, Queensborough Community College, Undergraduate School, *56th & Springfield Aves., Bayside, New York* 11364 (NCA 2-625901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

7.0004, COMPUTATIONAL FLUID DYNAMICS ON THE STAR
P.R. Garabedian, New York University, School of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (NSG 1579)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

7.0005, NONLINEAR REACTION DIFFUSION PHENOMENA
Unknown, Drexel University, Graduate School, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NSG 7491)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

7.0006, AN INVESTIGATION OF THE FEASIBILITY OF IMPROVING OCULOMETER DATA ANALYSIS THROUGH APPLICATION OF ADVANCED STATISTICAL TECHNIQUES
D.S. Rana, Old Dominion University, Graduate School, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NSG 1565)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, DYNAMIC SIMULATION OF CORONAL MASS EJECTIONS
R.S. Steinolfson, University of Alabama in Huntsville, Graduate School, *Huntsville, Alabama* 35807 (NAS 8-33216)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0002, EFFECT OF AEROSOLS INFLUENCED BY LOCAL LAND SEA INTERFACE ON RADIATIVE TRANSFER
Unknown, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (NCA 1-18)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0003, ATM GUEST INVESTIGATOR PROGRAM - EMPIRICAL STUDIES OF SOLAR FLARES - COMPARISON OF X-RAY AND H-ALPHA FILTERATIONS (ABBREV)
R.L. Moore, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAS 8-33215)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0004, SUPERFLUID DYNAMICS - NONSTATIONARY HEAT TRANSFER DUE TO SECOND SOUND SHOCK WAVES
Unknown, California Inst. of Technology, Graduate School, *1201 E. California Blvd., Pasadena, California* 91109 (NSG 7508)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0005, COLLISION PROCESSES INVOLVING EXCITED ATOMS
F.T. Smith, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (PHY78-09647)

This is a project in atomic and molecular physics in which the interactions of atoms in excited states are studied, continuing grant PHY76-14436 A02.

The collisional interactions of electronically excited and ground state atomic beams are being investigated in two sophisticated molecular beam scattering facilities. In one facility, the energy and angular distributions of scattered neutral and ionic particles will be measured, using both time-of-flight and electrostatic energy analysis. Atom-atom and atom-molecule inelastic processes, including electronic excitation and collisional ion-pair formation, will be studied; coincidence techniques will be used to investigate the important Penning ionization reaction. Another experimental facility will use laser pumping techniques to modify and define the excited state beam composition for metastable rare gas projectiles allowing measurements of collisional excitation transfer rates for a specified excited state. Similar laser techniques will be applied to the excitation of alkali target atoms for investigations of other collisional processes, including excited state-excited state reactions. This program is a new area of atomic collisions concerned with the detailed dynamics of excited state collisions at elevated energies. Since little detailed dynamic information is available for these excited state interactions, many opportunities exist for this work to contribute to the understanding of the basic collisional energy transfer process.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0006, INTERACTION BETWEEN A GRAZING FLOW OVER A HELMHOLTZ RESONATOR ORIFICE AND THE ACOUSTICALLY INDUCED VELOCITY IN IT (ABBREV)
A.F. Charwat, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Mechanics, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 3236)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0007, CHARACTERIZATION OF INFRARED OPTICAL PROPERTIES OF TRANSPARENT MATERIALS
R. Braunstein, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DF053070; AFOSR-78-3665)

AF function - high-energy laser science and technology is finding wide application in future Air Force systems. Opportunity - both in the generation of intense infrared coherent radiation and in the hardening of certain critical components to this radiation, understanding the basic interactions of photons with transparent solids is of extreme importance for the advancement of high-energy lasers. Objective - the broad objectives of this research are to further understanding of the intrinsic and extrinsic processes that characterize the infrared optical properties of materials. Intrinsic interactions such as Rayleigh scattering, multi-phonon absorption and other higher-order processes and the nature of the Urbach tail will be studied by experimental and theoretical techniques. Extrinsic processes such as the identification of chemical and structural imperfections as a function of temperature and pressure which occur in highly transparent semiconductors and insulators will be investigated. In addition to bulk optical properties, the optical properties of interface states between materials as well as disorder engendered by various methods of material preparation will be studied. How work contributes - the knowledge and understanding gained from a successful completion of these objectives will provide a basis for evaluating infrared laser window materials, optimizing their performance and evolving a predictive mechanism for their optical degradation and breakdown.

Three experimental approaches using wavelength modulation, light scattering, and thermally stimulated depolarization currents will be used to obtain information about intrinsic and extrinsic loss mechanisms in highly transparent materials. A unique wavelength modulated spectrometer will be employed to determine the spectral dependence of the absorption in these materials. Rayleigh optical scattering will be used to study the dynamics of density and concentration fluctuations in highly transparent materials. In addition, the method of thermally stimulated depolarization currents will be used to study dipole moment bearing defect states so as to determine the relaxation time and activation energies of these species. The results of these experiments will be used to develop the theoretical understanding of the loss processes occurring in highly transparent insulators and semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0008, ELECTRON-IMPACT EXCITATION OF MOLECULAR NITROGEN
C.A. Weatherford, State University System of Florida, Florida Agricultural & Mechanical University, School of Science &

Technology, Dept. of Chemistry, *Tallahassee, Florida* 32307 (NSG 5307)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0009, PLASMA VORTEX STRUCTURES
D.R. Wells, University of Miami, School of Arts & Sciences, Dept. of Physics, *Miami, Florida* 33124 (PHY77-07106 A01)

The research project in plasma physics is concerned with the study of naturally occurring, self-ordering stable plasma structures. These structures are investigated theoretically and experimentally. The theory is concerned with an application of variational principle and the use of appropriate constraint integrals which correspond to the physics of the experiment. The total 'free' energy of the plasma structures is varied subject to these constraints in order to find the most stable plasma configurations. The determination of appropriate and complete sets of constraints for various situations is of current interest. The resulting equations of motion for the plasma are compared to experimental results.

The particular plasma structures currently under investigations are generated by conical theta pinch guns. The resulting plasma vortex structures are guided to the center of a primary magnetic mirror. They are then compressed and amplified by adiabatic compression, utilizing a secondary magnetic mirror system. Various plasma diagnostics are used to determine plasma temperature before and after compression. Secondary compression by magnetic vacuum fields as high as 120,000 Gauss is currently under investigation.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0010, IMPURITIES IN SUPERCONDUCTORS
D.M. Ginsberg, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (EY-76-C-02-1198)

We are making specific heat measurements on superconducting films with rare-earth and iron-group impurities. The results should help to determine whether the influence of the impurities can be adequately predicted by perturbation theory, and whether the quantum mechanical nature of the impurity spin has to be explicitly taken into account (Kondo effect). We are also measuring the scattering of electrons by quantized magnetic vortices in superconducting films.

BIBLIOGRAPHIC REFERENCES: J.W. Thomasson and D.M. Ginsberg, Electromagnetic Penetration Dept in Superconductors with Magnetic Impurities, Phys. Rev. B15, 4270-4271 (1977).

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0011, MODELS OF THE ATMOSPHERES OF TERRESTRIAL PLANETS AND LOW-TEMPERATURE STARS, AND THE INTERIORS OF SATURN, URANUS AND NEPTUNE (ABBREV)
A.S. Grossman, Iowa State University of Science & Technology, College of Humanities & Sciences, Dept. of Physics, *Beardshear Hall, Ames, Iowa* 50010 (NCA 2-340902)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0012, RESONANCE FLUORESCENCE IN ATMOSPHERIC GASES RESEARCH
T.J. McIlrath, University of Maryland, College Park Campus, Inst. for Fluid Dynamics & Applied Mathematics, *College Park, Maryland* 20742 (NSG 5313)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0013, STUDY OF ENERGETIC PARTICLE BEAM INJECTION EXPERIMENTS IN IONOSPHERE AND MAGNETOSPHERE
K. Papadopoulos, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NAS 5-25388)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0014, ATOMIC PHYSICS EXPERIMENTS USING FAST ATOMIC BEAMS
F.M. Pipkin, Harvard University, Cambridge Campus, Graduate School, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PHY78-09657)

Fast atomic beams will be used in conjunction with laser and radiofrequency spectroscopy techniques to make precision measurements of the fine and hyperfine structure of the excited states of hydrogen-like atoms, to study charge exchange collisions, to measure the fine structure in the excited states of complex atoms and to measure the lifetimes of atomic states.

This work is a continuation of that currently supported by NSF Grant PHY76-14857 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0015, MOLECULAR BEAM, HYDROGEN MASER, AND STORED ATOM RESEARCH
N. Ramsey, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PHY77-13938 A01)

High-precision molecular beam magnetic resonance apparatus will continue to be used to study internal orientation-dependent interactions in molecules, such as nuclear electric quadrupole, nuclear spin-rotational and spin-spin magnetic interactions. Primary emphasis will be on non-polar molecules. The dependence of the electric and magnetic susceptibilities on molecular orientation and rotational distortion parameters of molecules will also be studied. Measurements of similar orientation-dependent interactions in polar molecules will be studied with a new molecular beam electric resonance apparatus which combines an unusually high precision electric resonance apparatus with a strong magnetic field. Atomic hydrogen masers will be studied and improved. Major improvements can be expected for a large storage box hydrogen maser with deformable walls, which has just recently come into operation. Hydrogen masers will be used to obtain more accurate values of the hyperfine separation and the effect of an electric field upon the hyperfine separation. Experiments with other stored atoms will be carried out by various methods including the hydrogen maser spin exchange technique.

This work represents a continuation of that currently supported by Foundation grant MPS-7412429.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0016, APOLLO TELESCOPE MOUNT GUEST INVESTIGATOR PROGRAM, FOR STUDYING CORONAL SOURCES OF THE INTRA STREAM STRUCTURE OF THE SOLAR WIND
J.D. Sullivan, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAS 8-33137)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0017, SUPERCONDUCTING TUNNELING INTO SINGLE CRYSTAL TANTALUM
M.L. Macvicar, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-07202)

A systematic investigation of strong coupling superconductivity in single crystal tantalum and single crystal vanadium will be made by means of tunneling studies. Strong coupling characteristics will be delineated at various temperatures between 0.3 and 4.4K. Similar experiments with Ta-In and Ta-Au junctions are planned to compare with Ta-Pb results. Fabrication techniques for single crystal vanadium substrate junctions will be developed. This work is important for characterization of the superconducting parameters in the transition elements.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0018, THEORY FORMULATION AND ANALYSIS SUPPORT FOR THE DYNAMICS EXPLORER SPACECRAFT

A.F. Nagy, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical Engineering, *Ann Arbor, Michigan* 48104 (NAS 5-25038)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0019, MEASUREMENTS OF THE 1-15 MEV EXTRATERRESTRIAL GAMMA-RAYS AND THE 3-70 MEV ATMOSPHERIC NEUTRONS

J.A. Lockwood, University System of New Hampshire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (ATM78-09702)

This grant will support balloon flights in 1978 and 1979 of a new University of New Hamsphire (UNH) neutron and gamma-ray (n-gamma) detector capable of measuring the fluxes, energy spectra, and angular distributions of neutrons and gamma-rays in the energy intervals from 3 MeV to 70 MeV and 1 MeV to 15 MeV respectively. The new system is a modification of the UNH n-gamma detector previously flown. The detector consists of two banks of scintillators separated by 1.2 m with a time-of-flight (TOF) system between the two banks. The upper detector consists of twelve NE 213 liquid scintillators each 7.5 cm x 7.5 cm in size. The lower bank has ten 12.5 cm x 5 cm sodium iodide scintillators and six scintillators. The pulse shape discrimination (PSD) in each scintillator cell separates the protons and alphas produced by neutrons from the electrons produced by gamma-ray interactions. Pulse height analysis on each interaction coupled with TOF measurements enables the direction and energies of neutrons and gamma-rays to be determined. The two detector banks are separately enclosed in anti-coincidence charged particle shields.

The flights will produce: (1) a measurement of the diffuse cosmic gamma-ray flux from 1-15 MeV; (2) upper limits on discrete gamma-ray sources in the 1-15 MeV energy range; (3) accurate atmospheric gamma-ray flux values; (4) angular distributions of neutrons from 3-70 MeV at the top of the atmosphere; and (5) the neutron energy spectrum from 3-70 MeV.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

8.0020, FUSION PLASMA THEORY

P.H. Rutherford, Princeton University, Plasma Physics Lab., *Box 430, Princeton, New Jersey* 08540

The overall purpose of the work is the understanding of the physics of plasma confinement and heating in closed magnetic configurations. The effort is closely coordinated with the experimental Tokamak program at the Princeton Plasma Physics Laboratory. Specific areas of work are: (1) magnetohydrodynamic equilibrium and stability; (2) plasma transport; (3) plasma microinstabilities; (4) plasma heating.

SUPPORTED BY U.S. Dept. of Energy, Div. of Magnetic Fusion Energy

8.0021, STATISTICAL MECHANICS

J.L. Lebowitz, Rutgers the State University of New Jersey, New Brunswick Campus, Graduate School, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (PHY78-15920)

Research in theoretical physics supported under NSF grant PHY77-22302 will be continued on a broad program of basic research in statistical mechanics of equilibrium and non-equilibrium phenomena. Particular emphasis will be given to the study of phase transitions in equilibrium systems and of stationary non-equilibrium states carrying currents, e.g., a steady heat flux.

Another area of interest is the so called 'transition from regular to irregular behavior' in dynamical systems. This phenomenon appears to be a general characteristic of a large class of non-linear systems occurring both in Hamiltonian and in (forced) dissipative systems. It has relevance in the first case to problems in chemical kinetics and various types of accelerators and in the latter case to fluid turbulence.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0022, THEORETICAL SOLID-STATE PHYSICS

E. Abrahams, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR76-23330 A01)

Research in theoretical solid-state physics carried out under grant DMR72-03230 will be continued. In particular, the program will be directed toward three general problems: (1) Transport coefficients of the normal Fermi liquid will be calculated by extending Eliashberg's theory to include finite temperature corrections. (2) The coupling of electrons to sound waves in piezoelectric materials will be studied, including the effect of this coupling on transport properties. (3) Research on dynamical phenomena near the lambda transition in liquid helium will be continued.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0023, PIEZO-SPECTROSCOPIC INVESTIGATION OF BANDS AND BONDS IN SOLIDS

F.H. Pollak, City University of New York, Brooklyn College, Graduate School, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (DMR78-03030)

The stress induced splittings and shifts of the electronic energy bands and phonon frequencies will be investigated for a number of different solids. Uniaxial stress provides a tool for probing locations of band extrema, symmetrics of interband transitions, deformation potentials, crystal field splittings, effective masses and excitonic transitions. The techniques to be used in these investigations include optical modulation spectroscopy, Raman scattering and resonance Raman scattering. Solids to be investigated include rutile materials, transition metal oxides and copper oxide.

This is a continuation of research previously supported by NSF grant DMR-7518936 at Yeshiva University.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0024, CONVECTION EFFECTS DURING BRIDGMAN GROWTH OF SEMICONDUCTORS

F. Carlson, Clarkson College of Technology, School of Engineering, Dept. of Industrial Engineering, *51 Main St., Potsdam, New York* 13676 (NSG 1572)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0025, A STUDY OF HOMOGENEOUS STEADY-STATE PLASMA IN RF ELECTROMAGNETIC FIELDS

H.H. Brown, New York University, School of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (PHY77-26928)

A new device will be constructed to form and maintain a plasma in a heated cavity. Barium atoms will be ionized so that optical diagnostics can be used to obtain detailed information concerning the plasma. The hot walls will form part of an rf cavity

so that microwave diagnostics can be used as a diagnostic and to supply an rf electric field for plasma interactions. Phenomena to be studied include: the effect of a pondermotive force, parametric instabilities, and turbulence.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0026, NONLINEAR WAVE PROPAGATION AND SUPER BOOM ANALYSIS
L. Ting, New York University, School of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (NSG 1576)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0027, ATOMIC STRUCTURE RELATIONSHIP IN AMORPHOUS AND CRYSTALLINE BORON FIBERS
G. Bambakidis, Wright State University, Graduate School, *Dayton, Ohio* 45431 (NSG 3240)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0028, MINORITY CARRIER INJECTION INTO MATERIALS CONTAINING TRAPS
H.K. Henisch, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DMR76-80619)

Experiments will be conducted on the voltage-current characteristics of metal-semiconductor and semiconductor-semiconductor contacts in two distinct operational regimes as regards trapping of injected minority carriers. The two regimes will be established by varying (a) the ambient temperature, and (b) the trap concentration, the latter through neutron bombardment and/or heat shock. Recently published theoretical treatments lead to the conclusion that trapping should play a major role in determining the voltage-current relationship in the forward direction, so much so that resistance increases have been predicted as a result of injection when the trap density is high enough. There are indications (from the published and unpublished results of other workers) that this is indeed the case, and the present project is intended as a designed experimental test under ideal conditions. Though effects related to surface states and effects related to bulk trapping cannot be unambiguously resolved by the measurement of a single voltage-current relationship, there should be no difficulty in resolving them by comparative experiments under distinctly different trapping probabilities, and by the in situ introduction of traps into a completed system. Germanium will receive principal attention, though it is also planned to perform comparative measurements on other single-crystal semiconductors.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0029, EXPERIMENTS AT LOW TEMPERATURE
G.M. Seidel, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR77-09593)

Research begun under NSF grant DMR73-07493 will be continued and extended. A new technique for measuring the density of helium gas has been developed and will be used to establish a more accurate temperature scale from 2 to 20 Kelvin. The resonant frequency of a superconducting microwave cavity will be used to measure the density of helium gas at low temperatures to an accuracy heretofore unattainable. The goal of the research is to establish a temperature scale one order of magnitude more accurate than the one now in use. This same microwave technique will also be applied to other problems as time and resources permit. The dispersion relation of helium-3 quasiparticles in helium-4 will be studied and investigations of the density of helium along the melting curve will be undertaken.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0030, SPIN DEPENDENCE OF ION-ATOM COLLISIONS AND HYPERFINE STRUCTURE OF SIMPLE IONS BY REORIENTATION SPECTROSCOPY OF STORED IONS
H.A. Schuessler, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (PHY76-81827 A01)

Novel experimental studies of the dependence of ion-molecule reactions and ion-photon processes on the orientation of the collision partners are being developed. Spin-dependent charge transfer reactions, spin exchange collisions, and spin-dependent rearrangement reactions will be explored. There is no existing experimental work on the electron spin dependence of charge transfer and rearrangement collisions, although it is generally recognized that spin is an important parameter. The proposed investigations of the basic aspect of ion molecule collisions will employ ion storage techniques. In such an experiment, polarized ions can be produced, stored for many minutes in ultrahigh vacuum, and nondestructively interrogated as to their spin state, after the collision of interest has taken place. Emphasis is placed on the study of simple systems, such as collisions between He ion, Hg ion, and Ba ions and polarized alkali and hydrogen atoms. Three series of experiments, all of which require the containment of charged atomic systems without loss of spin orientation, are planned.

After containment is accomplished, various reorientation collision schemes involving beams of oriented atoms, intense tunable laser light, and suitably chosen radio-frequency fields, are applied, and the reaction processes of interest are studied.

Simultaneously with the collision studies described, spectroscopic data of stored ions will be measured with high precision.

Additional experiments will measure the g-factors of He ion, Hg ion, and H2 ion in the ground state in an effort to compare these gj-factors with that of the free electron, measured in the same apparatus. The result will test the well-known relativistic Breit correction, which so far has not been observed directly.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0031, APPLIED PLASMA PHYSICS--FUSION PLASMA THEORY RESEARCH
W.E. Drummond, University of Texas, Austin Campus, Center for Plasma Physics & Thermonuclear Research, *200 W. 21st, Austin, Texas* 78712 (EY-76-C-05-4478)

The Fusion Research Center theoretical program is primarily directed toward understanding the heating and confinement of plasmas in a Tokamak configuration. A broad program of confinement studies applicable to the national program of Tokamak research has been continuing for several years. These studies include the theory of MHD equilibrium and stability in magnetic configurations, neoclassical transport, microinstabilities driven by the current and gradients in density and temperature, anomalous transport produced by these instabilities, and instabilities caused by the presence of high-energy particles, such as runaways or beams. Our goal is to understand each feature which may contribute to the heating and subsequent decay of the plasma, and finally, to combine these features into a unified description of the time evolution. In the next few years, as the TEXT and PRETEXT experimental programs get under way, we will turn our efforts increasingly toward the interpretation of observed phenomena in these Tokamaks, and, at the same time, continue to pay close attention to the development of analytic and numerical methods for dealing with the underlying plasma processes.

SUPPORTED BY U.S. Dept. of Energy, Div. of Magnetic Fusion Energy

8.0032, DYNAMICS OF COLLISIONLESS SYSTEMS
T.A. Zang, College of William & Mary, Williamsburg College, Graduate School, *Ewell Hall, Williamsburg, Virginia* 23185 (NSG 1564)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0033, THEORETICAL STUDY OF SOLAR PUMPED LASERS
W.L. Harries, Old Dominion University, School of Sciences & Health Professions, Dept. of Physics & Geophysics, *P.O. Box 6173, Norfolk, Virginia* 23508 (NSG 1568)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0034, INVESTIGATION OF DIRECT INTEGRATED OPTICS MODULATORS
T.E. Batchman, University of Virginia, School of Engineering & Applied Science, Dept. of Electrical Engineering, *Garrett Hall, Charlottesville, Virginia* 22903 (NSG 1567)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

8.0035, SURFACE STRUCTURES, LATTICE DYNAMICS AND ADATOM INTERACTIONS
M.B. Webb, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DMR78-16650)

Research on the atomic arrangements, thermal vibrations, thermodynamics and kinetic properties of surfaces and adsorbed atoms, previously supported by NSF grant no. DMR76-21576, will be continued. Experiments using the low energy electron diffraction technique will be performed on Si (100) and (111) surfaces, both clean and with adsorbed gases, and Ag (111) surfaces with adsorbed Xe and other noble gases. The information obtained will contribute significantly to the understanding of the electronic and chemical processes of semiconductor surfaces, and of the interactions of adsorbed gas atoms with the substrate surface and with each other.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, HISTORY OF PLANETARY PHYSICS
S.G. Brush, University of Maryland, College Park Campus, Inst. for Physical Science & Technology, *College Park, Maryland* 20742 (SOC77-26749)

Dr. Brush is conducting historical research in the area of nineteenth and twentieth century geophysics and astrophysics, with special emphasis on the connections of these sciences with the so-called 'fundamental' parts of physical science (atomic theory, thermodynamics, electromagnetism, relativity). In addition to publications on the history of planetary physics, he expects that the project will ultimately lead to a book on the history of modern physical science in which the development of planetary physics and its relations to other disciplines are included.

Dr. Brush is currently concentrating on a detailed study of changes in ideas about the early development and internal constitution of the earth since 1830, and on the development of astrophysical, geological and chemical sciences relating to theories of the origin of the solar system in the twentieth century. He is examining aspects such as the impact of discoveries in celestial mechanics, radioactivity, and seismology, reasons for the rejection and later revival of ideas such as nebular origin of the solar system, planetesimal hypothesis, fluid regions inside the earth, and continental drift; and the interactions of scientific disciplines such as astronomy, physics, geology, chemistry and applied mathematics.

SUPPORTED BY U.S. National Science Foundation, Div. of Social Sciences

9.0002, A CAPACITY-THEORETIC APPROACH TO WORKLOAD ASSESSMENT
H.A. Colle, Wright State University, Graduate School, *Dayton, Ohio* 45431 (DF052210; AFOSR-78-3595)

AF function - this research examines a capacity-theoretic metric which can be used for assessing workload requirements, especially within the context of aircrew operations. Deficiency - workload assessment is very difficult in cockpit activities since attentional demands made on different crew members are hard to observe and quantify. Yet good workload measures are needed to satisfy aircraft design questions and provide aircrew performance measurement for training. Objective - this research will attempt to validate a capacity-theoretic approach to measuring workload. How work contributes - the current technology for assessing workload will be advanced as a result of this effort. Better performance measures should improve R and D for aircrew training.

The principal investigator has developed quantitative approach to workload assessment which employs a fixed capacity theory of attentional demand where each person has a maximal amount of processing resources which can be distributed among the tasks to be performed. Some work completed by the investigator during an AFOSR summer faculty program using performance operator curves suggests that the assumption of fixed capacity is a valid one. This research will test that assumption further in its general form using visual memory classification, paced auditory digit-shadowing, and digit-adding tasks in a dual-task paradigm.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

9.0003, PILOT PROGRAM TO DEVELOP AGGREGATE BASE OPERATING SUPPORT WORK LOAD INDICATORS FOR USE IN AIR STAFF-LEVEL MANPOWER MANAGEMENT
R.L. Somers, General Research Corp., *7655 Old Springhouse Rd., McLean, Virginia* 22101 (DF051680; F49620-78-C-0048)

AF function - manpower resource management within the Air Force involves determining, compiling and projecting future manpower requirements, documenting these requirements, integrating them into the overall defense planning, programming and budgeting process, justifying them to OSD, OMB and Congress, and translating them into a form which provides a basis for personnel procurement, training and assignment actions. The process is dynamic and encompasses interrelated activities at field, major command and department of the Air Force levels. Field management engineering teams (METs) develop detailed manpower requirements with Air Staff Directorate of Manpower and Organization (AF/PRM) policy guidance, and technical direction from the Air Force Management Engineering Agency (AFMEA). Deficiency - manpower standards developed by the METs provide rationale and methodology for distribution of manpower by the major commands. Similar, but more aggregate, standards are required by AF/PRM to support the overall justification and allocation of manpower. Objective - the research will develop and validate a methodology for the derivation and application of aggregate base operating support (BOS) workload indicators through a pilot or feasibility test. How work contributes - workload measures will be expressed in terms of input (man-years)/output (aggregate work units or representative workload indicators) relationships for BOS functions, functional groupings and program elements (PEs). They will be designed for application to internal manpower management problems, such as evaluation of command requests for increases and allocations of reductions and justification of requirements to OSD, OMB and the Congress.

The research will involve the actual derivation of aggregate workload indicators/manpower relationships for selected BOS functions, PEs and commands on a pilot-test basis. Accepted technique for curve fitting and the drawing of statistical inferences will be applied. Efforts will be made to resolve anomalies and clarify questionable analytical results. Problems and limitations will be fully documented, along with a recommended approach for continuing Air Force development and application of

aggregate workload indicators for management of manpower resources.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, STUDIES OF POLARIZATION IN ASTRONOMICAL OBJECTS
J.R. Angel, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST78-22714)

The research to be carried out under this grant will be concerned with studies of the optical polarization found in several different kinds of astronomical objects. Most of the objects to be studied are those which emit polarized light such as white dwarf stars and quasars. The program of research will also include development of a fully automated polarimeter. Specific areas of research will be: (1) Magnetic white dwarf stars. There will be an attempt to identify features in the spectra of these stars. These white dwarf stars have magnetic fields 100 million times greater than the magnetic field of the earth. The origin of this magnetic field will be investigated. (2) AM Hercules stars. There are three white dwarf stars which exhibit extreme circular polarization, and these objects are unique. These stars are in binary systems and it appears that mass is falling onto the surface of the white dwarf star. The nature of this mass flow near the surface star will be studied by recently developed high-speed, two color polarimetry. (3) Active galactic nuclei. The polarization properties of quasars, Seyfert galaxies and BL Lacertae objects will be studied. (4) Maps. A survey will be made of the types of polarization found in various types of galaxies. The distribution of dust and magnetic fields in galaxies will be examined. An attempt will be made to identify polarized synchrotron radiation in radio galaxies.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, COMPUTER EQUIPMENT
C.P. Sonett, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (ATM78-15223)

This grant is the purchase of equipment for refurbishment and upgrading of the computational facilities of the Department of Planetary Sciences of the University of Arizona (U of A). These funds combined with counterpart funds from the U of A and supplemented by funds both from current and proposed grants from the National Aeronautics and Space Administration (NASA) will be used to increase the operational speed of the present computer, install new software operational systems, replace and extend the input/output (I/O) subsystems, and install software protocol for a batch mode link with the National Center for Atmospheric Research (NCAR). The past growth of computation in the Lunar and Planetary Laboratory (LPL -- the research institute of the Department) and the anticipated needs lead to the choice of a VAX 11/780. The increased capability and cost-effectiveness resulting from the improvement will more than justify the investment.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0003, ASTEROID POPULATION STATISTICS
B.H. Zellner, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (NSG 7502)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0004, DEVELOPMENT AND OPERATION OF THE VLBI PROCESSOR
M.H. Cohen, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astron, *1201 E. California Blvd., Pasadena, California* 91109 (AST77-22963)

The angular resolution of radio telescopes has steadily increased with time. Today, the largest single dish steerable radio telescopes have a resolution of about one arc minute, which is comparable to the unaided human eye. In order to obtain higher resolution at radio wavelengths, a technique known as interferometry is employed, and such a technique uses two or more small radio telescopes separated by distances varying from several hundred meters to several kilometers. These telescopes are directly connected to each other by cables or waveguides. In order to obtain longer baselines and higher resolutions, it becomes necessary to use microwave links between telescopes, and antennas up to 100 km apart are used, and resolutions of about one arc second are obtained. Radio sources with dimensions very much smaller than one arc second are known and resolutions of this order can only be achieved using transcontinental or intercontinental baselines. These distances are too great for direct electrical or radio connections. Instead, high speed tape recordings are made of the signals at each station, and these tapes are then sent to a central laboratory where they are analyzed by a special-purpose computer. Such a computer is known as a processor. This project will involve expanding the capabilities of the processor at the California Institute of Technology so that it can analyze data from four or five radiotelescopes simultaneously. There will be other improvements to the system which will result in faster, more efficient collection and analysis of the radio data.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, DETECTION OF GRAVITATIONAL RADIATION BY THE DOPPLER TRACKING OF SPACECRAFT
B. Mashhoon, California Inst. of Technology, Graduate School, *1201 E. California Blvd., Pasadena, California* 91109 (NSG 7495)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0006, DEVELOPMENT OF NEW STRATEGIES TO IMPROVE SIERRA COLLEGE UNDERGRADUATE LABORATORY ASTRONOMY
R.S. Marsasso, Sierra College, Undergraduate School, Dept. of Astronomy, *5000 Rocklin Rd., Rocklin, California* 95677 (SER78-06060)

This project, identified as 'Close-Up', is designed to accommodate the laboratory mode of astronomy at Sierra College. Over 500 students per year will gain exposure to a specially designed vehicle serving as a mini-lab classroom capable of being located at the various higher altitude, dark sky observing sites situated throughout the College's 2700 square mile district. The mini-lab vehicle will be equipped with all necessary equipment for data collection, processing (on-board photo darkroom), and analysis, including a closed-circuit television system designed to give all students attending field sessions simultaneous viewing of celestial objects as they appear in the field of relatively large telescopes. This 'live' viewing of the night sky will be video-recorded for playback before larger groups at another time, or for comparison of live image to previously recorded image of the same field to measurably demonstrate the magnitude of change which may occur on the celestial sphere. Project Close-Up will provide effective means for improving undergraduate science education utilizing modern and innovative teaching strategies. An evaluation committee will monitor the progress of the program as several advisory groups provide continuous input to the program's refinement and extended application to all science field studies in post grant years.

SUPPORTED BY U.S. National Science Foundation, Div. of Science Education Resources Improvement

10.0007, STRUCTURE AND COMPOSITION OF THE ISM FLUORESCENCE AND SELF-ABSORPTION AT LOW ENERGIES IN BINARY X-RAY SOURCES USING SAS-3 (ABBREV)
A.B. Walker, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (NSG 7476)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0008, SOLAR FLARE PREDICTION
J.H. Richter, U.S. Dept. of Defense, Navy, Naval Electronics Lab. Center, Engineering Sciences Dept., *San Diego, California* 92152 (DN888505)

Determination of solar flare precursor and development of forewarning criteria for the purpose of improved naval communication by minimizing the effects of communications blackouts and disturbances caused by solar flares.

High-resolution solar radiation temperature contour maps will be analyzed by examining the temporal & spatial characteristics of active regions at 3.3 mm, 8.6 mm, 2.0 cm, 3.2 cm and 9.1 cm wavelengths. By comparing active-region parameters obtained from the analysis, a description will be developed to be used in solar flare modeling and to determine solar flare precursor criteria. Correlations to solar emissions at other wavelengths (i.e., optical, x-ray, etc.) will also be considered.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Environmental Prediction Research Facility

10.0009, 'AETHER DRIFT' AND THE ISOTROPY OF THE UNIVERSE
G.F. Smoot, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720 (NSG 2344)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0010, OPTICAL OBSERVATIONS OF CELESTIAL X-RAY SOURCES
B. Margone, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (AST77-27745)

A research program to study several characteristics of galactic and extragalactic X-ray sources will be carried out using the latest ground-based spectrophotometric, photometric, and photographic techniques. A major portion of the effort will be devoted to discovering visible or near-infrared counterparts of galactic X-ray binary stars by using the very accurate X-ray positions available from recent satellite experiments. The objects so identified, plus a number of already known identifications, will be observed spectroscopically to help understand the effects of the nearby X-ray source on the structure and evolution of the relatively normal companion star. Results of this research will bear directly on several problems on the late stages of stellar evolution. Because most X-ray sources are thought to involve a collapsed object, such as a neutron star or black hole, these data will provide insights which are impossible to gain in the laboratory concerning the physics of these very unusual stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0011, ASTRONOMICAL APPLICATIONS OF CHARGED COUPLED DEVICE TECHNOLOGY
J.S. Miller, University of California, Santa Cruz Campus, Graduate School, Dept. of Astronomy, *Santa Cruz, California* 95060 (NSG 7503)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0012, OBJECTIVE-PRISM RADIAL VELOCITIES OF STARS
A.R. Upgren, Wesleyan University, Graduate School, Dept. of Astronomy, *Middletown, Connecticut* 06457 (INT75-06683 A02)

This is a joint program between the Van Vleck Observatory of Wesleyan University, Middletown, Connecticut and the Fundacion Centro de Investigacion de Astronomia 'Francisco J. Duarte' in Merida, Venezuela, for the purpose of determining the radial velocities of groups of stars. Astronomers at the two observatories participate in the measuring, reduction and analysis of the results of the observations which are made in Venezuela. The observations consist of photographs taken with the wide-field Schmidt Telescope using an objective prism which causes each star to appear as a small spectrum. The positions of the lines in each spectrum can be measured and the radial (or line-of-sight) velocity can be determined from the measures since lines are shifted by the Doppler effect toward the violet (or red) if the star is approaching (or receding) and the amount of shift is proportional to the speed. The radial velocities of many thousands of stars can be determined only by this method. They can then be used to provide new and extensive information on the basic stellar components of our Milky Way Galaxy as well as its rotation. The new Venezuelan Schmidt Telescope has two unique advantages for this program: it is the largest in the world equipped with an objective prism and it is located near the Equator and thus can view all parts of the sky. The work contemplated is a continuation of research under a previous award, NSF No. OIP75-06683.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

10.0013, SPECTROSCOPIC STUDIES RELATING TO SEVERAL OUTSTANDING PROBLEMS IN STELLAR EVOLUTION THEORY AND EARLY GALACTIC CHEMICAL EVOLUTION
D. Butler, Yale University, Graduate School, *206 Elm, New Haven, Connecticut* 06520 (AST76-83413 A01)

This research will be primarily concerned with determining the physical properties of a group of variable stars known as BL Herculis stars. Such stars are known to exist in globular clusters of the galactic halo, and in the general galactic field. They are also found in the Small Magellanic Cloud and in the dwarf spheroidal galaxies. A study will be made of the metal abundances of RR Lyrae variable stars in the Magellanic Clouds. There will be a low resolution spectroscopic study of giant and subgiant stars in the globular cluster NGC 6397. This work will be concerned with the isotopic abundances of carbon in the photospheres of these stars. A study of the carbon, nitrogen and oxygen abundances of the field RR Lyrae stars in our galaxy will be completed.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0014, SOLAR CORONAL HOLES AND ENVIRONMENTAL DISTURBANCES AND TECHNIQUES FOR FLARE PREDICTION
R.N. Smartt, U.S. National Science Foundation, *1800 G St. N.W., Washington, District of Columbia* 20550 (DF582000)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions of AF communications and detection systems. Objective - assist the Air Weather Service in improving the monitoring and prediction of disturbances and study coronal holes and their relations to the geomagnetic index. How research contributes - enables Air Force monitoring capability in detection and routine observation of coronal emission-line intensities and detection of coronal holes. Emission features and coronal holes which may have possible subsequent geomagnetic effects can be detected several days in advance of the solar surface activity producing these coronal disturbances.

Techniques are to be developed and applied to existing SPO coronal photometer for the added capability of observing two additional coronal emission lines and also increasing the signal-to-noise ratio to allow more efficient detection of coronal holes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

10.0015, ULTRAVIOLET OBSERVATIONS OF COPERNICUS DATA
J.A. Simpson, University of Chicago, School of Physical Sciences, Dept. of Physics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (NSG 5311)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0016, A LABORATORY EXPERIMENT OF AN IONOSPHERIC INTEREST - MICROWAVE SCATTERING BY A SYSTEM OF PLASMA WAVES OR IRREGULARITIES
N. Dangelo, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (ATM78-00529)

A process of cosmic noise absorption (CNA), involving backscatter of 20-30 MHz electromagnetic radiation of cosmic origin by E region plasma waves, has been recently suggested. The relevant E region plasma waves are produced by the Farley-Buneman instability, which is excited by large ionospheric electric fields.

This grant funds studies in the laboratory, in a multidipole plasma device, of the scattering of electromagnetic radiation (3 cm mu waves) by systems of Farley-Buneman waves. Scattering cross-sections will be measured for a given level of Farley-Buneman turbulence. This will then be compared to theory to test its validity and/or seek improvements therein.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0017, STUDY OF INTERSTELLAR MATTER AND CHROMOSPHERES
H.W. Moos, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (NSG 5310)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0018, OPPORTUNITY OBSERVATIONS OF OCCULTATIONS AND ECLIPSES
J.L. Elliot, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 2342)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0019, APPLICATION OF A DOUBLE COMPTON TELESCOPE TO MEASUREMENTS OF THE 1-15 MEV EXTRA-TERRESTRIAL GAMMA RAYS
J.A. Lockwood, University System of New Hampshire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (NSG 7481)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0020, THEORETICAL PROBLEMS OF SPIRAL GALAXIES
C. Yuan, City University of New York, City College, Graduate School, *Convent Ave. & 138th St., New York, New York* 10031 (NSG 2348)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0021, FAR INFRARED SPECTRAL LINE OBSERVATIONS FROM THE G.P. KUIPER AIRBORNE OBSERVATORY
M.O. Harwit, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Astronomy, *Ithaca, New York* 14850 (NSG 2347)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0022, RADIATION INDUCED ROTATION OF SMALL CELESTIAL BODIES
Unknown, State University of New York, Albany Campus, Graduate School, *1400 Washington Ave., Albany, New York* 12203 (NSG 7501)

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10.0023, DETERMINATION OF A GALACTIC GRADIENT - MEASUREMENTS OF THE FINE STRUCTURE LINES OF ARII, AND SIII IN GALACTIC HII REGIONS
J.L. Pipher, University of Rochester, School of Arts & Sciences, Dept. of Physics, *260 Crittenden Blvd., Rochester, New York* 14627 (NSG 2343)

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10.0024, A PROGRAM OF FAR-INFRARED OBSERVATIONS OF STAR FORMATION REGIONS IN MOLECULAR CLOUDS
N.J. Evans, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (NSG 2345)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0025, COPERNICUS ULTRAVIOLET SPECTROSCOPIC OBSERVATIONS
M.A. Smith, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (NSG 5309)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0026, ION VELOCITY INSTRUMENT FOR SAN MARCO SPACECRAFT
W.B. Hanson, University of Texas, Health Science Center at Dallas, Graduate School of Biomedical Sciences, Dept. of Physics, *5323 Harry Hines Blvd., Dallas, Texas* 75235 (NAS 5-25310)

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10.0027, CALCULATIONS OF FORBIDALEN LINE EMISSION FROM HOT, INTERSTELLAR GAS REGIONS
M. Kafatos, George Mason University, Undergraduate School, Dept. of Physics, *4400 University Dr., Fairfax, Virginia* 22030 (NSG 5305)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

10.0028, GALACTIC ELECTRONS, ENERGY SPECTRUM OVER 300 GEV
J.J. Lord, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle*, *Washington* 98105 (INT78-06972)

This award will support Professor Jere J. Lord of the University of Washington in Seattle over a period of two years in a program of cooperative instrumented balloon flights with Professor Jun Nishimura of the Institute of Space and Aeronautical Science, University of Tokyo, for the purpose of studying cosmic radiation at ultra-high energies. Professor Lord and another member of his research group will travel to Tokyo for coordination and training in preparation for several research balloon launches from Palestine, Texas, and for final analysis of data, utilizing experimental facilities at the University of Tokyo.

The project will utilize emulsion chamber detection techniques to study the high-energy portion of the primary cosmic ray electron spectrum, one of the important problems in astrophysics where improved data is necessary to determine the origin of the electron component. The results derived from this research will have an important bearing on the origin of cosmic rays and their propagation through the galaxy. The joint efforts of the U.S. and Japanese research groups in the design, fabrication, and operation of the balloon instruments and in the subsequent analysis of data will make possible the performance of reliable measurements in a program too large to be handled by a single research group.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

GENERAL

11.0001, JOINT DEVELOPMENT OF A YOUTH SCIENCE CONGRESS
S.N. Stein, California State University & Colleges, San Jose State University, Graduate School, *Washington Sq.*, *San Jose*, *California* 95192 (NCA 2-675811)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

11.0002, OPERATION OF A NASA INDUSTRIAL APPLICATION CENTER
Unknown, Southeastern Oklahoma State University, Graduate School, *Durant*, *Oklahoma* 74701 (NASW 3180)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

VOLUME 17 NUMBER 11 / JUNE 8, 1979

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N79-19988* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 106
Feb. 1979 113 p
(NASA-SP-7037(106)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 388 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1979. Author

N79-19989*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ADVANCED TECHNOLOGY AIRFOIL RESEARCH, VOLUME 1, PART 2
1978 303 p refs Proceedings of Conf. held at Hampton, Va., 7-9 Mar. 1978
(NASA-CP-2045-Vol-1-Pt-2; L-12232) Avail: NTIS HC A14/MF A01 CSCL 02A

This compilation contains papers presented at the NASA Conference on Advanced Technology Airfoil Research held at Langley Research Center on March 7-9, 1978, which have unlimited distribution. This conference provided a comprehensive review of all NASA airfoil research, conducted in-house and under grant and contract. A broad spectrum of airfoil research outside of NASA was also reviewed. The major thrust of the technical sessions were in three areas: development of computational aerodynamic codes for airfoil analysis and design, development of experimental facilities and test techniques, and all types of airfoil applications. For individual titles, see N79-19990 through N79-20007.

N79-19990*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PARAMETRIC EXPERIMENTAL STUDY OF THE SLOTTED-WALL BOUNDARY CONDITION c02
Joel L. Everhart and Richard W. Barnwell *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 459-471 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01A

An experimental study of slotted upper and lower walls in a two dimensional transonic wind tunnel with solid sidewalls is reported. Results are presented for several slot spacings and slot openness ratios. The experimental data were pressure measurements which were made on an airfoil model and on a sidewall near one of the slotted walls. The slotted-wall boundary condition coefficient, which related the pressure and streamline curvature near the wall, was determined from the wall pressure measurements. The measured wall-induced interference was correlated with the experimental values for the boundary condition coefficient. This correlation was compared with theory. J.A.M.

N79-19991*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TRANSONIC ASSESSMENT OF TWO-DIMENSIONAL WIND TUNNEL WALL INTERFERENCE USING MEASURED WALL PRESSURES c09
William B. Kemp, Jr. *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 473-486 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 14B

A method is described for assessing wall interference in two dimensional wind tunnels with better realism and accuracy than is achieved with methods based on classical wall interference theory. Measured pressure distributions were imposed as boundary conditions on a nonlinear transonic form of the potential equation to obtain an accurate computational reproduction of the actual tunnel flow. Wall-induced velocity perturbations were then extracted to yield both corrections to the tunnel test conditions and a measure of the adequacy of these corrections to account for tunnel interference. Application of the method to a transonic tunnel with variable porosity walls is illustrated. J.A.M.

N79-19992*# Calspan Corp., Buffalo, N. Y.
RESEARCH ON SELF-CORRECTING WIND TUNNELS c09
R. J. Vidal and J. C. Erickson, Jr. *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 487-498 refs (For primary document see N79-19989 11-01) (Contracts N00014-72-C-0102; N00014-77-C-0052; F40600-76-C-0011)
Avail: NTIS HC A14/MF A01 CSCL 14B

The Calspan self-correcting wind tunnel is a two-dimensional facility in which the flow field in the vicinity of the walls is actively controlled, and a theoretical evaluation is used in conjunction with flow field measurements to confirm that wall interference was minimized. The facility is described, and the results of experiments with a 6 percent-blockage model are presented to show that iterative application of wall control effectively eliminates the interference. Experiments were performed at conditions where the flow at the walls was supercritical, and a new operating procedure is described for these conditions. The results of an analysis of the flow in the auxiliary suction system and test ion illustrate the tradeoffs available in the design of self-correcting wind tunnel test sections and in model sizing for such tunnels. J.A.M.

N79-19993*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYTICAL DESIGN OF A CONTOURED WIND-TUNNEL LINER FOR SUPERCRITICAL TESTING c09
Perry A. Newman and E. Clay Anderson *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 499-509 refs (For primary document see N79-19989 11-01)
(Contract NAS1-14517)
Avail: NTIS HC A14/MF A01 CSCL 14B

The present analytical design procedure is being developed in order to determine the shape of a contoured nonporous wind tunnel liner for use in the Ames 12-foot pressure wind tunnel test of a large chord, laminar flow control, swept wing panel which has a supercritical airfoil section. This procedure is applicable

to the two-dimensional streamlined tunnel problem wall shape with that found experimentally. J.A.M.

N79-19994*# Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.
EVALUATION OF INTERFERENCE IN THE OSU 6 IN. BY 22 IN. TRANSONIC AIRFOIL TUNNEL c09
John D. Lee *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 511-525 ref (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 14B

Interference in a 6 in. by 22 in. two-dimensional wind tunnel was evaluated at Mach numbers up to 1.06 by comparing pressure distributions from airfoil models of differing size. Models of the NACA 0012 profile, having chords of 76, 152, and 305 mm, were used in one phase of the evaluation program, and models of a supercritical profile, having chords of 76 and 152 mm, were used in another. The confinement interference, was documented i.e., blockage, downwash and streamline curvature, all of which are quite small on a model having a chord of 152 mm and which can, for most applications, be ignored. Specifically, the corrections were lumped into an attack angle adjustment of -0.16 degrees per unit lift coefficient on a 152 mm model. J.A.M.

N79-19995*# Notre Dame Univ., Ind.
VISUALIZATION OF THE SEPARATION AND SUBSEQUENT TRANSITION NEAR THE LEADING EDGE OF AIRFOILS c02
Anthony V. Arena and Thomas J. Mueller *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 527-538 refs (For primary document see N79-19989 11-01) (Grant NsG-1419)
Avail: NTIS HC A14/MF A01 CSCL 01A

A visual study was performed using the low speed smoke wind tunnels with the objective of obtaining a better understanding of the structure of leading edge separation bubbles on airfoils. The location of separation, transition and reattachment for a cylindrical nose constant-thickness airfoil model were obtained from smoke photographs and surface oil flow techniques. These data, together with static pressure distributions along the leading edge and upper surface of the model, produced the influence of Reynolds number, angle of attack, and trailing edge flap angle on the size and characteristics of the bubble. Additional visual insight into the unsteady nature of the separation bubble was provided by high speed 16 mm movies. The 8 mm color movies taken of the surface oil flow supported the findings of the high speed movies and clearly showed the formation of a scalloped spanwise separation line at the higher Reynolds number. J.A.M.

N79-19996*# Wichita State Univ., Kans.
INSTRUMENTATION, TECHNIQUES AND DATA REDUCTION ASSOCIATED WITH AIRFOIL TESTING PROGRAMS AT WICHITA STATE UNIVERSITY c35
Edward J. Rodgers, William H. Wentz, Jr., and H. C. Seetharam (Boeing Commercial Airplane Co.) *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 539-558 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 14B

Two dimensional airfoil testing was conducted at the Wichita State University Beech Wind Tunnel for a number of years. The instrumentation developed and adapted during this period of testing for determination of flow fields along with traversing mechanisms for these probes are discussed. In addition, some of the techniques used to account for interference effects associated with the apparatus used for this two dimensional testing are presented. The application of a minicomputer to the data reduction and presentation is discussed. J.A.M.

N79-19997*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF THE LASER VELOCIMETER TO AIRFOIL RESEARCH c36
Danny R. Hoad *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 559-570 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 20E

A laser velocimeter (LV) was installed in the Langley V/STOL tunnel to measure the velocity field about a wing with a NACA 0012 airfoil section. These measurements were compared at low angle of attack with a two dimensional, viscous flow prediction program. The velocity field over the wing in a fully stalled condition was also measured by the LV. The unique ability of the LV to measure absolute flow magnitude and direction without prior knowledge of general flow direction was demonstrated in the complex separated reverse flows near the wing upper surface at the high angle of attack. The general characteristics of the flow field over the stalled wing were substantiated by a vapor screen flow visualization technique. J.A.M.

N79-19998*# Owen (F. K.), Palo Alto, Calif.
APPLICATIONS OF DYNAMIC MEASUREMENT TECHNIQUES TO WIND-TUNNEL TESTING c02
F. K. Owen *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 571-588 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01A

The uses of laser Doppler velocimeter, hot wire, and surface hot film techniques in the study of turbulent flows are described, and data obtained in compressible flows are discussed. Applications are illustrated with measurements of wind tunnel freestream turbulence characteristics and with data obtained in transitional, turbulent, and separated shear flows. A new method which was developed for the study of time dependent and unsteady turbulent flows is also presented. J.A.M.

N79-19999*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HOLOGRAPHY AND LDV TECHNIQUES, THEIR STATUS AND USE IN AIRFOIL RESEARCH c35
D. A. Johnson and W. D. Bachalo (Spectron Development Labs., Inc.) *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 589-599 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 14E

The measurement capabilities of laser velocimetry and holographic interferometry in transonic airfoil testing were demonstrated. Presented are representative results obtained with these two nonintrusive techniques on a 15.24 cm chord airfoil section. These results include the density field about the airfoil, flow angles in the inviscid flow and viscous flow properties including the turbulent Reynolds stresses. The accuracies of the density fields obtained by interferometry were verified from comparisons with surface pressure and laser velocimeter measurements. L.S.

N79-20000*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
SECTION DRAG COEFFICIENTS FROM PRESSURE PROBE TRANSVERSES OF A WING WAKE AT LOW SPEEDS c02
Lawrence C. Montoya, Paul F. Bikle (Soaring Society of America), and Richard D. Banner *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 601-621 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01A

An in-flight wing wake section drag investigation was conducted using traversing pitot and static probes. The primary objective was to develop measurement techniques and improve the accuracy of in-flight wing profile drag measurements for low values of dynamic pressure and Reynolds number. Data were obtained on a sailplane for speeds from about 40 knots to 125 knots at chord Reynolds numbers between 1,000,000 and 3,000,000. Tests were conducted with zero flap deflection, deflected flaps, and various degrees of surface roughness, and for smooth and rough atmospheric conditions. Several techniques were used to increase data reliability and to minimize certain bias errors. A discussion of the effects of a total pressure probe in a pressure gradient, and the effects of discrete turbulence levels, on the data presented and other experimental results is also included. L.S.

N79-20001*# Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.
FLIGHT TEST TECHNIQUES FOR LOW SPEED AIRFOIL EVALUATION c05
M. J. Hoffmann, G. M. Gregorek, and G. S. Weislogel *In* NASA.

Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 623-642 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01C

Techniques for in-flight evaluation of new airfoils by modifying a single engine general aviation aircraft and measuring and recording airfoil surface pressures, airfoil wake pressures, and aircraft angle of attack and airspeed are presented. Included are descriptions of the aircraft modifications, instrumentation, data reduction techniques, illustrations of typical results and comments on new equipment for flight test applications. Author

N79-20002*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
IN-FLIGHT THREE-DIMENSIONAL BOUNDARY LAYER AND WAKE MEASUREMENTS FROM A SWEPT SUPERCRITICAL WING **c05**
David P. Lux *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 643-655 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01A

Three-dimensional boundary layer and wake velocity profiles were measured in flight on the supercritical wing of the F-111 transonic aircraft technology aircraft. These data, along with pressure distributions, were obtained to establish a data base with which data obtained by three-dimensional analytical techniques could be correlated. Only a brief summary of the total data base is given. The data presented represented one chord station at a wing leading-edge sweep angle of 26 deg. They cover an angle of attack range from 6 degs to 9 degs at free-stream Mach numbers from 0.85 to 0.90. A brief discussion of the techniques used to obtain the boundary layer and wake profiles is included. Author

N79-20003*# Boeing Commercial Airplane Co., Seattle, Wash.
A PROCEDURE FOR ANALYZING TRANSONIC FLOW OVER HARMONICALLY OSCILLATING AIRFOILS **c02**
Warren H. Weatherill, F. Edward Ehlers, and James D. Sebastian *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 657-670 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01A

Finite difference procedures were successfully used to solve the steady transonic flow about airfoils and appear to provide a practical means for calculating the corresponding unsteady flow. The purpose of the paper is to describe a finite difference procedure derived from the equations for the potential flow by assuming small perturbations and harmonic motion. The velocity potential is divided into steady and unsteady parts, and the resulting unsteady equation is linearized on the basis of small amplitudes of oscillation. The steady velocity potential, which must be calculated first, is described by the classical nonlinear transonic differential equation. Author

N79-20004*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A NEW TWO-DIMENSIONAL OSCILLATING WING APPARATUS FOR UNSTEADY AERODYNAMICS RESEARCH **c09**
Sanford S. Davis and Gerald N. Malcolm *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 671-688 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 14B

An apparatus for experimental research into unsteady transonic flows is described. The apparatus, as installed in the NASA-Ames 11 by 11 Foot Transonic Wind Tunnel, can impart full two-degree-of-freedom motions at reduced frequencies to 0.3, oscillatory amplitudes to tn-2 degs, mean angles to 12 degs, Mach numbers to 1.4 and Reynolds numbers to 12x10. The test wing is fully instrumented for dynamic waveform measurements and the data can be acquired, processed, and displayed in real-time with a new computational data acquisition system. Following a description of the apparatus, sample data from a recently completed test program is presented. L.S.

N79-20005*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOME CALCULATIONS OF TRANSONIC POTENTIAL FLOW FOR THE NACA 64A006 AIRFOIL WITH OSCILLATING FLAP **c02**
Robert M. Bennett and Samuel R. Bland *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 689-700 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01A

A method for calculating the transonic flow over steady and oscillating airfoils was developed by Isogai. It solves the full potential equation with a semi-implicit, time-marching, finite difference technique. Steady flow solutions are obtained from time asymptotic solutions for a steady airfoil. Corresponding oscillatory solutions are obtained by initiating an oscillation and marching in time for several cycles until a converged periodic solution is achieved. In this paper the method is described in general terms, and results are compared with experimental data for both steady flow and for oscillations at several values of reduced frequency. Good agreement for static pressures is shown for subcritical speeds, with increasing deviation as Mach number is increased into the supercritical speed range. Fair agreement with experiment was obtained at high reduced frequencies with larger deviations at low reduced frequencies. Author

N79-20006*# Boeing Vertol Co., Philadelphia, Pa.
OBSERVATIONS ON THE DYNAMIC STALL CHARACTERISTICS OF ADVANCED HELICOPTER ROTOR AIRFOILS **c08**
L. Dadone *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 701-715 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01C

A significant amount of research was devoted to understanding the mechanism of dynamic stall delay as applicable to the flow environment of a helicopter rotor in forward flight. One aspect of such research deals with the unsteady characteristics of two-dimensional airfoil sections over a Mach number range from 0.3 to 9.6, since such characteristics can be meaningfully related to rotor performance and loads. This paper summarizes the results of several oscillatory tests carried out on conventional, transonic and BLC-equipped airfoils. Author

N79-20007*# General Dynamics/Convair, San Diego, Calif.
TRANSONIC FLOW OVER THE NACA 64A006 WITH AN OSCILLATING FLAP-CALCULATIONS BASED ON THE EULER EQUATIONS **c02**
R. J. Magnus *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 717-728 refs (For primary document see N79-19989 11-01)
(Contract F33615-76-C-3018)
Avail: NTIS HC A14/MF A01 CSCL 01A

Exploratory calculations of transonic flows over the airfoil with a quarter-chord oscillating flap were made using a program which obtains approximate solutions to the Euler equations with an explicit, shock-capturing, finite-difference scheme. The calculations, essentially inviscid and for the airfoil at zero angle-of-attack in a free-stream, are at Mach numbers and reduced frequencies which were tested in experiments by Tijdeman. The oscillatory lifts from analogus calculations by various investigators generally agree with one another better than they agree with Tijdeman's data. Inclusion in the calculations of an approximate modelling of boundary conditions expected at slotted wind tunnel walls tends to shift some of the results closer to the experimental values. L.S.

N79-20008*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATERIALS AND STRUCTURAL ASPECTS OF ADVANCED GAS-TURBINE HELICOPTER ENGINES
John C. Freche (US Army Aviation Res. and Develop. Command, Cleveland) and John Acurio 1979 65 p refs To be presented at the Intern. Congr. in Aeron., Paris, 6-8 Jun. 1979
(NASA-TM-79100; AVRADCOM-TR-79-4) Avail: NTIS HC A04/MF A01 CSCL 21E

The key to improved helicopter gas turbine engine performance lies in the development of advanced materials and advanced structural and design concepts. The modification of the low temperature components of helicopter engines (such as the inlet particle separator), the introduction of composites for use in the engine front frame, the development of advanced materials

with increased use-temperature capability for the engine hot section, can result in improved performance and/or decreased engine maintenance cost. A major emphasis in helicopter engine design is the ability to design to meet a required lifetime. This, in turn, requires that the interrelated aspects of higher operating temperatures and pressures, cooling concepts, and environmental protection schemes be integrated into component design. The major material advances, coatings, and design life-prediction techniques pertinent to helicopter engines are reviewed; the current state-of-the-art is identified; and when appropriate, progress, problems, and future directions are assessed. A.R.H.

N79-20009# Advisory Group for Aerospace Research and Development, Paris (France).
THE IMPACT OF INTEGRATED GUIDANCE AND CONTROL TECHNOLOGY ON WEAPONS SYSTEMS DESIGN
Dec. 1978 242 p refs Presented at the Guidance and Control Panel Symp., Sandefjord, Norway, 9-12 May 1978
(AGARD-CP-257; ISBN-92-835-1303-7) Avail: NTIS HC A11/MF A01

Rapidly developing sensor technology when combined with advancing technologies in guidance and control, the driving forces of acquisition and life cycle costs, needs for operational tactical flexibility, survivability, vulnerability, and critical volume and weight constraints, dictates the need for integrated guidance and control at a higher functional level than heretofore considered. This higher functional level involves an effective blend of the sensor, vehicle and kill-mechanism that can provide a multirole capability for advanced and present operational vehicles. For individual titles, see N79-20010 through N79-20028.

N79-20010# European Office of Aerospace Research and Development, London (England).
THE IMPACT OF INTEGRATED GUIDANCE AND CONTROL TECHNOLOGY ON WEAPONS SYSTEM DESIGN c08
Eugene L. DeNezza *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 5 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

The history of guidance and control technology since the 1950's is summarized with emphasis on the progression from the vehicle to air warfare systems. Potential capabilities of command control and communication are examined in relation to tactical control where substantial dynamic and functional integration are needed to provide the desired operational capability. Benefits from space-time positioning, on-board trajectory control, and six-degree-of-freedom are discussed. Guidance and control have a dominant role in the functional structuring of advanced system because of the closed loop dynamics and the design methods required to blend the sensor-vehicle-kill mechanism in a manner that can effectively use multisensor inputs as well as the vehicle's dynamics capability to achieve the precision night, all-weather delivery capability. This can be physically implemented using digital information processed data systems. A.R.H.

N79-20011# Armament Development and Test Center, Eglin AFB, Fla.
NEW WEAPON CONCEPTS DEVELOPED FROM ADVANCED NAVIGATION GUIDANCE AND TARGETING TECHNOLOGY c04
H. E. Brown *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 2 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

A highly integrated 'Smart-Package' concept is presented showing how advanced imaging systems and data processing techniques could be used to develop an automatic system for searching, detecting, identifying and selecting targets, and for controlling the simultaneous attack of a group of weapons. Each individual weapon of the group launched would be directed to a specific target. This approach could lead to multiple kills per weapon launched and greatly reduce the pilot work load. Several weaponization concepts are presented to illustrate optional applications of the smart-package. In each case the smart-package is selecting targets in real time as the weapon system flies over the target area. There are some technology voids in these concepts; namely, the data processing algorithms for false target discrimination are not fully developed. A.R.H.

N79-20012# Department of the Navy, Washington, D. C.
COST AND DESIGN ADVANTAGES DERIVED FROM THE STANDARD ELECTRONIC MODULES PROGRAM c33
David Gold, John M. Kucharski (EG and G Washington Analytical Services Center, Rockville, Md.), and Davis R. Bates (Raytheon Co., Sudbury, Mass.) *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 14 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

The standard electronic modules program is a highly successful design standardization program that is commanding considerable attention within the U. S. Department of Defense as a result of its achieving significant cost and reliability results. This program establishes a rational discipline for the development process for military electronic systems by providing families of functional electronic modules which are already developed, documented, and qualified, and for which a wide industrial base exists. Although this program has been heavily oriented at resolving system maintenance and logistical support problem areas, it nevertheless constitutes a readily available and highly effective building block approach for accomplishing research and development functions. Author

N79-20013# Hughes Aircraft Co., Canoga Park, Calif.
GLOBAL POSITIONING SYSTEM TACTICAL MISSILE GUIDANCE c81
Frederick W. Hardy and C. David DePriest (Air Force Armament Lab.) *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 12 p refs (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

The concept of GPS tactical missile guidance is discussed from the standpoint of advantages gained by high level functional integration between the missile and a GPS-equipped launch aircraft. The conflicting requirements of high performance and low cost are shown to be attained by elimination of missile guidance functions that can be performed by the aircraft GPS system and transferred to the missile immediately prior to launch. The importance of integrating missile GPS receiver and inertial guidance system measurements for achieving maximum performance in a jamming environment is discussed, as well as the filter form employed and resulting performance. The unique operational advantages of this GPS missile guidance system for weapon delivery are described, including those gained by integration with a GPS-equipped aircraft. Author

N79-20014# Marconi-Elliott Avionic Systems Ltd., Rochester (England). Airport Works.
DIGITAL FLIGHT CONTROL SYSTEM ARCHITECTURE AND IMPLEMENTATION c08
G. Belcher, P. A. Daniell, and E. M. Scott *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 6 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

Digital flight systems must be designed to match their specific functional requirements if they are to satisfy the integrity, performance and cost targets. The architecture must be simple and modular so that it can be readily analyzed. There must be a one to one correspondence between software and hardware to ensure visibility, particularly for the Failure Mode Effect analysis. Modularity enables flexibility to be maintained during development and permits development costs to be shared between projects. A modular system is described and its associated communication and control system, which uses a standard interface, is outlined. The advent of the digital microprocessor has extended the range of viable architecture and has made multiprocessor configurations (particularly dual processor) attractive. In such configurations, 16 bit microprocessors perform auxiliary functions such as data management and/or self test. The degree of self test can extend from preflight testing to full monitoring, in which the microprocessor undertakes a dissimilar check of the main processor, thereby protecting against common mode failures which can occur in a multiple, similar redundant system. Author

N79-20015# Lear Siegler, Inc., Grand Rapids, Mich.
DEVELOPMENT OF THE INTEGRATED FLIGHT TRAJECTORY CONTROL CONCEPT c08

M. W. Bird, W. L. Young (AFFDL), L. Addis, and G. L. Comegys *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 15 p refs (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

Operational missions into heavily defended target zones with the likelihood for deviations from the intended routes and redirections from Command and Control centers will impose heavy workload demands upon the pilot/aircrew. The approach selected by the integrated flight trajectory control (IFTC) program involves: (1) combinating the functions of flight control systems and navigation computers; (2) developing techniques for four dimensional trajectory generation and display; and (3) developing procedures for operating on information received via data link. The system is complementary to the pilot and, by its logical operation, reduces the potential for pilot error in high stress situations. The operational advantages offered by the system and the method of evaluating its performance are discussed.
A.R.H.

N79-20018# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
REDUNDANT STRAPDOWN NAVIGATION, GUIDANCE, AND CONTROL OF A CONTROL CONFIGURED VEHICLE **c04**
Wolfgang J. Kubbat and George A. Napjus *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 18 p refs Prepared in cooperation with Teledyne Systems Co., Northridge, Calif. (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

The hardware and software mechanization of the integrated guidance and control system of the CCV-F104-G is explained with special focus on the strapdown part. This includes the solution to the redundancy problem. Finally, the next feasible steps in system improvement and minimization of the inertial part are outlined.
Author

N79-20017# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
PRELIMINARY FEASIBILITY ASSESSMENT OF MULTI-FUNCTION INERTIAL REFERENCE ASSEMBLY (MIRA) **c06**
John M. Perdzock and Robert C. Burns *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 16 p ref Prepared in cooperation with McDonnell Douglas Corp., St. Louis, Mo. (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

Mission and performance goals established for MIRA feasibility studies covering flight control, navigation and weapon/cargo delivery as applied to the F-15 aircraft and a transport aircraft are discussed. The relationship between the key technical issues of concern and the feasibility criteria and the methodology to perform the trade-offs which impact life cycle costs are described. Functional performance and reliability requirements are shown. Computational requirements for a representative MIRA system are summarized. Computer programs were used to evaluate time histories of sensor and system error propagation and to assess the impact on flight control system control laws as MIRA sensors are installed at various aircraft installation locations. The criteria defined to perform the preliminary feasibility assessment is discussed. Comparative studies of life cycle costs show a saving estimate in excess of 69 million dollars for MIRA application to a quantity of 144 fighters over a 15 year operational life. Cost savings for transport applications are qualitatively significant, particularly for the operations and support cost element. The results of ring laser gyro and tuned rotor gyro studies of performance and reliability improvements required are summarized.
A.R.H.

N79-20018# Norwegian Defence Research Establishment, Kjeller.
APPLICATION OF PARALLEL FILTERS FOR MALFUNCTION DETECTION AND ALTERNATIVE MODE CAPABILITY **c04**
T. Smestad and O. Orpen *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 8 p refs (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

A software method is described for malfunction detection and alternate mode capability in dynamic systems where slowly increased sensors errors may occur. The method is based on parallel Kalman filters and tests on the filter outputs. The implementation of this method in the integrated navigation system for the new Norwegian coastguard vessels is discussed. Some preliminary simulation results are presented.
A.R.H.

N79-20019# Marconi-Elliott Avionic Systems Ltd., Borehamwood (England). Airborne Display Div.
CONTROL AND DISPLAY CONCEPTS FOR COMBAT AIRCRAFT **c06**
R. H. Holmes *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 12 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

The need for low pilot workload in future combat aircraft equipped with electronic displays is discussed. Means by which this may be achieved through optimization of display functions and rationalization of controls are examined. Current work on head up displays and helmet sighting systems is highlighted.
A.R.H.

N79-20020# Ferranti Ltd., Edinburgh (Scotland). Inertial Systems Dept.
AN ADVANCED NAVIGATION DISPLAY AND ITS EFFECT ON SYSTEM DESIGN **c06**
W. H. McKinlay *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 4 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

A display which would normally be located immediately below the head-up display in order to show the horizontal situation was developed. The operational requirements are discussed for the COMED combined display which includes a full color topographical map based on 35 mm film and a multimode electronic display capable of accepting cursive or raster information. A planning aid permitting horizontal flight profiles to be digitized automatically in a briefing room from a conventional paper map is described. Flight plan processing is possible and the resultant data can be loaded into a portable store which is then inserted into the aircraft system so that the planned profile can be superimposed on the topographical map. The display was fully developed and demonstrated in flight and the planning aid completed successful operational trials.
A.R.H.

N79-20021# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
METHODS FOR THE VALIDATION OF SYNTHESIZED IMAGES IN VISUAL FLIGHT SIMULATION **c09**
Gert Doerfel *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 10 p refs (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

To validate the information content of synthetic visual flight simulation, objectively based methods and criteria are necessary which can show the influence of a variety of visual cues on pilots' perception. Fifty-six pilots and 28 nonpilot enlisted men made height and distance judgements from landing approach scenes with different levels of detail. Some judgements of height and distance were made in relation to a previously shown standard scene. Other judgements (absolute) were given in ft or m. To evaluate the influence of scene information simplification on subjects' perception of height and distance, a number of measures were made including judgement time, error and the exponent of the stimulus-response relationship. Judgement error and the exponent of fitted power-functions both were significantly influenced by scene stylization. The increase of judgement error and the decrease of power-function exponent respectively are more distinct when making absolute judgement than relative ones. Because results for pilots are quite different, nonpilots should not be used as subjects for visual research work with landing scenes.
Author

N79-20022# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

DESIGN CONSIDERATIONS FOR IMPLEMENTING INTEGRATED MISSION-TAILORED FLIGHT CONTROL MODES **c08**

James K. Ramage and Frank R. Swortzel *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 18 p refs (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

Some of the more critical design considerations are discussed for successfully integrating decoupled flight path control, mission-tailored control modes, and fault in a multi-role, high performance fighter aircraft design, to achieve improved overall mission effectiveness and cost of ownership without sacrificing system reliability and safety. The recently completed Fighter Control Configured Vehicles (CCV) Program flight test of the yf-16 aircraft provided valuable insight and substantiating technical data for future design and application of active control technology. This program was primarily concerned with the development and evaulation of decoupled six degrees-of-freedom flight path control techniques. Specific CCV features evaluated during the flight test program included (1) maneuver enhancement/gust alleviation, (2) direct lift and sideforce control, (3) independent fuselage pointing and translation, and (4) variable relaxed static stability. Implementation of these CCV capabilities presents unique pilot interface considerations, which must be addressed in terms of required displays, controllers, vehicle response dynamics and mission segment applications. A.R.H.

N79-20023# Litton Systems, Inc., Woodland Hills, Calif. Guidance and Control Systems Div.
TARGET MARKER PLACEMENT FOR DIVE-TOSS DELIVERIES WITH WINGS NON-LEVEL **c08**

J. Stanley Ausman *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 11 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

In a dive-toss, air-to-ground weapon delivery, the pilot steers a target marker symbol or sight reticle (pipper) so as to overlay the target with that symbol. He then depresses a target designation (pickle) switch which commands the computer to record all available target sensor data. From these data the weapon delivery computer first calculates the location of the target and then generates steering signals to guide the pilot in steering the calculated weapon impact point onto the target whereupon the computer automatically issues the weapon release signal. The motion of the calculated impact point during a banked pullup or climbing turn is analyzed to determine the path followed by the calculated impact point during such a maneuver. Placement of the sight reticile along this path allows the pilot to pull straight back on the stick after designating the target without first unrolling to a wings level attitude. A.R.H.

N79-20024# Hughes Aircraft Co., Canoga Park, Calif. Missiles Systems Group.
EXPENDABLE DIGITAL COMPUTERS IN TACTICAL MISSILE TRENDS AND TRADEOFFS IN SOFTWARE AND HARDWARE **c60**

H. A. Maurer and K. S. Kongelbeck *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 9 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

Computers are shown to be an effective way of achieving lower cost and improved performance in tactical guided missiles. Within the confines of currently available semiconductor technology a tactical missile computer is shown to be best applied in a central processor architecture. In this type of systems, a single computer performs the computational tasks of each of the guidance units' subfunctions and also serves as the overall system integrator. Two examples of this structure are given. The complexity of the required tactical missile computer depends on the complexity of the missile to which it is applied. Three classes of missile complexity and four classes of computers are identified. Which computer is required for each of the missile complexity classes is then demonstrated. Missile computer requirements differ considerably from those of other computer systems. The nature of and reasons for these differences are discussed. Finally, an extrapolation of current technology trends is made and projections as to the effect of these trends on tactical missile computer architecture are presented. Author

N79-20025# Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse (France).
A RELIABLE AND SURVIVABLE DATA TRANSMISSION SYSTEM FOR AVIONICS PROCESSING **c06**

D. R. Powell, J. C. Laprie, P. Romand (Societe Crouzet), and G. Alcouffe (Societe Crouzet) *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 12 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

The interconnection of real-time processing elements is discussed with emphasis on the choice of a two-level structure containing a distributed irregular network and a set of local 'star structures'. The irregular network has active nodes that carry out automatic signal routing whereas the star structure has a passive central node based on a loosely-coupled pulse transformer. Two types of communication control presently under analysis are content control and a decentralized daisy chain. The final choice will be based on security and modularity criteria. A.R.H.

N79-20026# Singer-Kearfott, Wayne, N. J.
DYNAMIC SIMULATION OF A MULTI-SENSOR COMMUNICATION AND NAVIGATION SYSTEM **c09**

Joseph N. Frisina, William J. Steele, and Jory I. Schlenger *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 13 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

Multi-sensor communication and navigation system avionic software is comprised of a real-time airborne operating system (RTAOS), a communication subsystem based on the time division muxiplexed access (TDMA) method, a tactical navigation (TACAN) subsystem, and a relative navigation (REL NAV) subsystem. Because this avionic software was written in assembly language there existed a very stringent requirement for a dynamic simulator for both development and validation of the avionic software. COMMANDS was developed to meet this requirement for an economical tool that would support the test requirements of both the communication (TDMA) subsystem's high data rates, and the complex computational requirement of the relative navigation system. The COMMANDS simulator is resident on a mini-computer, and is physically connected to the JTIDS Class 2 operational flight program terminal through the operational input/output I/O devices. This allows the simulation of the avionic box which is receiving the same inputs in the laboratory test as it will under flight conditions. A.R.H.

N79-20027# Boeing Aerospace Co., Seattle, Wash.
RADIO FREQUENCY (RF) HOMING MISSILE GUIDANCE AND CONTROL SIMULATION TECHNIQUES, FACILITIES, AND EXPERIENCES **c09**

G. D. Swetnam and F. M. Belrose (Redstone Arsenal, Huntsville, Ala.) *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 32 p refs (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

The basic RF homing missile guidance simulation problem is described as well and and solutions that have evolved over the past 20 years. Starting from simple component transfer function measurements in the late 1940's and early 1950's, the evolution of RF homing guidance simulation techniques is followed to present day hardware-in-the-loop facilities at Boeing, the United States Army's Radio Frequency Simulation System (RFSS), and the United States Navy's Central Target Simulator (CTS). A.R.H.

N79-20028# British Aerospace Aircraft Group, Warton (England).
MISSION SIMULATION AS AN AID TO DISPLAY ASSESSMENT **c09**

P. Beckett and D. E. A. Houghton *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 12 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

Advances in computer and display technology make possible drastic changes in aircraft cockpit layout. Investigations involving

full mission simulation in an advanced cockpit environment are reported. The philosophies and methods adopted and the hardware required for such simulation are discussed and areas where problems were encountered are indicated. A.R.H.

N79-20029# Advisory Group for Aerospace Research and Development, Paris (France).
HIGHLIGHTS
Mar. 1979 36 p
(AGARD-HIGHLIGHTS-79/1) Avail: NTIS HC A03/MF A01

Topics covered include: the Von Karman medal 1978; Portuguese National Day; biographical sketches of the newly appointed AGARD: chairman, Allan M. Lovelace, and director, Jack Burnham; prospects for propulsion and energetics; summary of 1979 meeting themes, and obituary for Michael Anastassaides. A.R.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N79-20030*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ADVANCED TECHNOLOGY AIRFOIL RESEARCH, VOLUME 1, PART 1
1979 454 p refs Conf. held at Hampton, Va., 7-9 Mar. 1978
(NASA-CP-2045-Vol-1-Pt-1; L-12232) Avail: NTIS HC A20/MF A01 CSCL 01A

A comprehensive review of all NASA airfoil research, conducted both in-house and under grant and contract, as well as a broad spectrum of airfoil research outside of NASA is presented. Emphasis is placed on the development of computational aerodynamic codes for airfoil analysis and design, the development of experimental facilities and test techniques, and all types of airfoil applications. For individual titles, see N79-20031 through N79-20059.

N79-20031*# National Aeronautics and Space Administration, Washington, D. C.
NASA RESEARCH OBJECTIVES AND ROLES
Alfred Gessow *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 1-9 (For primary document see N79-20030 11-02)
Avail: NTIS HC A20/MF A01 CSCL 01A

A chronology of airfoil development is presented in order to put the present NASA airfoil program in perspective. The impact of the NACA series airfoils is considered. Development of advanced analytical and experimental methods for the design and for the determination of the characteristics of not only single element airfoils, but of multielement airfoil combinations used in aerodynamic controls and high lift systems is emphasized along with applications. J.M.S.

N79-20032*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LANGLEY AIRFOIL-RESEARCH PROGRAM
Percy J. Bobbitt *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 11-38 refs (For primary document see N79-20030 11-02)
Avail: NTIS HC A20/MF A01 CSCL 01A

An overview of past, present, and future airfoil research activities at the Langley Research Center is given. The immediate past and future occupy most of the discussion; however, past accomplishments and milestones going back to the early NACA years are dealt with in a broad-brush way to give a better perspective of current developments and programs. In addition to the historical perspective, a short description of the facilities which are now being used in the airfoil program is given. This is followed by a discussion of airfoil developments, advances in airfoil design and analysis tools (mostly those that have taken place over the past 5 or 6 years), and tunnel-wall-interference predictive methods and measurements. Future research requirements are treated. J.M.S.

N79-20033*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OVERVIEW OF TWO-DIMENSIONAL AIRFOIL RESEARCH AT AMES RESEARCH CENTER
Gary T. Chapman *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 39-44 ref (For primary document see N79-20030 11-02)
Avail: NTIS HC A20/MF A01 CSCL 01A

The five basic elements of the two dimensional airfoil research program at Ames Research Center are illustrated. These elements are experimental, theoretical (including computational), validation, design optimization, and industry interaction. Each area is briefly discussed. J.M.S.

N79-20034*# New York Univ., N. Y.
TRANSONIC AIRFOIL CODES
P. R. Garabedian *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 45-54 refs (For primary document see N79-20030 11-02)
(Grants NGR-33-016-167; NGR-33-016-201; Contract EX-76-C-02-3077)
Avail: NTIS HC A20/MF A01 CSCL 01A

Computer codes for the design and analysis of transonic airfoils are considered. The design code relies on the method of complex characteristics in the hodograph plane to construct shockless airfoil. The analysis code uses artificial viscosity to calculate flows with weak shock waves at off-design conditions. Comparisons with experiments show that an excellent simulation of two dimensional wind tunnel tests is obtained. The codes have been widely adopted by the aircraft industry as a tool for the development of supercritical wing technology. J.M.S.

N79-20035*# Texas A&M Univ., College Station.
APPLICATION OF DIRECT-INVERSE TECHNIQUES TO AIRFOIL ANALYSIS AND DESIGN
Leland A. Carlson and Bruce M. Rocholl *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 55-72 refs (For primary document see N79-20030 11-02)
(Grant NsG-1174)
Avail: NTIS HC A20/MF A01 CSCL 01A

The direct-inverse technique was developed into a numerical method, called TRANDES, that is suitable for the analysis and design of subsonic and transonic airfoils and for the evaluation of design concepts. A general description of the method is given and its application to a design analysis type of problem is demonstrated. A usage of the method for the low speed high lift case is discussed. J.M.S.

N79-20036*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LOW SPEED AIRFOIL DESIGN AND ANALYSIS
Richard Eppler (Stuttgart Univ., West Germany) and Dan M. Somers *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 73-100 refs (For primary document see N79-20030 11-02)
Avail: NTIS HC A20/MF A01 CSCL 01A

A low speed airfoil design and analysis program was developed which contains several unique features. In the design mode, the velocity distribution is not specified for one but many different angles of attack. Several iteration options are included which allow the trailing edge angle to be specified while other parameters are iterated. For airfoil analysis, a panel method is available which uses third-order panels having parabolic vorticity distributions. The flow condition is satisfied at the end points of the panels. Both sharp and blunt trailing edges can be analyzed. The integral boundary layer method with its laminar separation bubble analog, empirical transition criterion, and precise turbulent boundary layer equations compares very favorably with other methods, both integral and finite difference. Comparisons with experiment for several airfoils over a very wide Reynolds number range are discussed. Applications to high lift airfoil design are also demonstrated. J.M.S.

N79-20037*# Rockwell International Science Center, Thousand Oaks, Calif.

A CONSISTENT DESIGN PROCEDURE FOR SUPERCRITICAL AIRFOILS IN FREE AIR AND A WIND TUNNEL

Vijaya Shankar, Norman D. Malmuth, and Julian D. Cole (California Univ., Los Angeles) *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 101-117 refs (For primary document see N79-20030 11-02)
(Contract F44620-76-C-0044)
(AIAA-Paper-78-103) Avail: NTIS HC A20/MF A01 CSCL 01A

A computational inverse procedure for transonic airfoils in which shapes are determined supporting prescribed pressure distributions is presented. The method uses the small disturbance equation and a consistent analysis-design differencing procedure at the airfoil surface. This avoids the intermediate analysis-design-analysis iterations. The effect of any openness at the trailing edge is taken onto account by adding an effective source term in the far field. The final results from a systematic expansion procedure which models the far field for solid, ideal slotted, and free jet tunnel walls are presented along with some design results for the associated boundary conditions and those for a free flight. J.M.S.

N79-20038*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PROSPECTS FOR COMPUTING AIRFOIL AERODYNAMICS WITH REYNOLDS AVERAGED NAVIER-STOKES CODES

George S. Deiwert and H. E. Bailey *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 119-131 refs (For primary document see N79-20030 11-02)
Avail: NTIS HC A20/MF A01 CSCL 01A

The Reynolds averaged Navier-Stokes equations are solved numerically for a variety of transonic airfoil configurations where viscous phenomena are important. Illustrative examples include flows past sensitive geometries, Reynolds number effects, and buffet phenomena. J.M.S.

N79-20039*# Ohio State Univ., Columbus. General Aviation Airfoil Design and Analysis Center.

AN EVALUATION OF FOUR SINGLE ELEMENT AIRFOIL ANALYTIC METHODS

R. J. Freuler and G. M. Gregorek *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 133-162 refs (For primary document see N79-20030 11-02)
(Contract NAS1-14406)
Avail: NTIS HC A20/MF A01 CSCL 01A

A comparison of four computer codes for the analysis of two-dimensional single element airfoil sections is presented for three classes of section geometries. Two of the computer codes utilize vortex singularities methods to obtain the potential flow solution. The other two codes solve the full inviscid potential flow equation using finite differencing techniques, allowing results to be obtained for transonic flow about an airfoil including weak shocks. Each program incorporates boundary layer routines for computing the boundary layer displacement thickness and boundary layer effects on aerodynamic coefficients. Computational results are given for a symmetrical section represented by an NACA 0012 profile, a conventional section illustrated by an NACA 65A413 profile, and a supercritical type section for general aviation applications typified by a NASA LS(1)-0413 section. The four codes are compared and contrasted in the areas of method of approach, range of applicability, agreement among each other and with experiment, individual advantages and disadvantages, computer run times and memory requirements, and operational idiosyncrasies. J.M.S.

N79-20040*# Boeing Co., Seattle, Wash.

UPGRADED VISCOUS FLOW ANALYSIS OF MULTI-ELEMENT AIRFOILS

Guenter W. Brune and Joseph W. Manke *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 163-181 refs (For primary document see N79-20030 11-02)
(Contract NAS1-14522)
Avail: NTIS HC A20/MF A01 CSCL 01A

A description of an improved version of the NASA/Lockheed multi-element airfoil analysis computer program is presented. The improvements include several major modifications of the aerodynamic model as well as substantial changes of the computer code. The modifications of the aerodynamic model comprise the representation of the boundary layer and wake displacement effects with an equivalent source distribution, the prediction of wake parameters with Green's lag-entrainment method, the calculation of turbulent boundary layer separation with the method of Nash and Hicks, the estimation of the onset of confluent boundary layer separation with a modified form of Goradia's method, and the prediction of profile drag with the formula of Squire and Young. The modifications of the computer program for which the structured approach to computer software development was employed are also described. Important aspects of the structured program development such as the functional decomposition of the aerodynamic theory and its numerical implementation, the analysis of the data flow within the code, and the application of a pseudo code are discussed. J.M.S.

N79-20041*# Mississippi State Univ., State College.

NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR ARBITRARY TWO-DIMENSIONAL MULTI-ELEMENT AIRFOILS

Joe F. Thompson, Louie Turner, W. Serrill Long, and John H. Bearden *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 183-207 refs (For primary document see N79-20030 11-02)
(Grant NGR-25-001-005)
Avail: NTIS HC A20/MF A01 CSCL 01A

The development of a numerical simulation of time dependent, turbulent, compressible flow about two dimensional multi-element airfoils of arbitrary shape is described. The basis of this simulation is a technique of automatic numerical generation of coordinate systems fitted to the multiple bodies regardless of their number or shape. Procedures developed whereby the coordinate lines are automatically concentrated in the boundary layer at any Reynolds number are discussed. The compressible turbulent solution involves an algebraic eddy viscosity turbulence model. The laminar version was run for transonic flow at free stream Mach numbers up to 0.9. J.M.S.

N79-20042*# Grumman Aerospace Corp., Bethpage, N.Y.

THE ANALYSIS AND DESIGN OF TRANSONIC TWO-ELEMENT AIRFOIL SYSTEMS

G. Volpe and B. Grossman *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 209-220 refs (For primary document see N79-20030 11-02)
(Contract N00014-75-C-0722)
Avail: NTIS HC A20/MF A01 CSCL 01A

The multiphase effort in the development of tools for the analysis and design of two-element airfoil systems, that is, airfoils with a slat or a flap at transonic speeds is described. The first phase involved the development of a method to compute the inviscid flow over such configurations. In the second phase the inviscid code was coupled to a boundary layer calculation program in order to compute the loss in performance due to viscous effects. An inverse code that constructs the airfoil system corresponding to a desired pressure distribution is described. J.M.S.

N79-20043*# McDonnell Aircraft Co., St. Louis, Mo.

IMPROVEMENTS IN SURFACE SINGULARITY ANALYSIS AND DESIGN METHODS

Dean R. Bristow *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 221-236 refs (For primary document see N79-20030 11-02)
Avail: NTIS HC A20/MF A01 CSCL 01A

The coupling of the combined source vortex distribution of Green's potential flow function with contemporary numerical techniques is shown to provide accurate, efficient, and stable solutions to subsonic inviscid analysis and design problems for multi-element airfoils. The analysis problem is solved by direct calculation of the surface singularity distribution required to satisfy the flow tangency boundary condition. The design or inverse problem is solved by an iteration process. In this process, the geometry and the associated pressure distribution are iterated until the pressure distribution most nearly corresponding to the prescribed design distribution is obtained. Typically, five iteration cycles are required for convergence. A description of the analysis and design method is presented, along with supporting examples. J.M.S.

N79-20044*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

OPTIMIZATION OF MULTI-ELEMENT AIRFOILS FOR MAXIMUM LIFT

Lawrence E. Olsen *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt.1 1979 p 237-253 refs (For primary document see N79-20030 11-02)

Avail: NTIS HC A20/MF A01 CSCL 01A

Two theoretical methods are presented for optimizing multi-element airfoils to obtain maximum lift. The analyses assume that the shapes of the various high lift elements are fixed. The objective of the design procedures is then to determine the optimum location and/or deflection of the leading and trailing edge devices. The first analysis determines the optimum horizontal and vertical location and the deflection of a leading edge slat. The structure of the flow field is calculated by iteratively coupling potential flow and boundary layer analysis. This design procedure does not require that flow separation effects be modeled. The second analysis determines the slat and flap deflection required to maximize the lift of a three element airfoil. This approach requires that the effects of flow separation from one or more of the airfoil elements be taken into account. The theoretical results are in good agreement with results of a wind tunnel test used to corroborate the predicted optimum slat and flap positions.

J.M.S.

N79-20045*# Grumman Aerospace Corp., Bethpage, N.Y.

WAKE CURVATURE AND TRAILING EDGE INTERACTION EFFECTS IN VISCOUS FLOW OVER AIRFOILS

R. E. Melnik *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 255-270 refs (For primary document see N79-20030 11-02)

(Contract NAS1-12426)

Avail: NTIS HC A20/MF A01 CSCL 01A

A theory developed for analyzing viscous flows over airfoils at high Reynolds numbers is described. The theory includes a complete treatment of viscous interaction effects induced by the curved wake behind the airfoil and accounts for normal pressure gradients across the boundary layer in the trailing edge region. A brief description of a computer code that was developed to solve the extended viscous interaction equations is given. Comparisons of the theoretical results with wind tunnel data for two rear loaded airfoils at supercritical conditions are presented.

J.M.S.

N79-20046*# Michigan Univ., Ann Arbor.

A STUDY OF THE INTERACTION OF A NORMAL SHOCK WAVE WITH A TURBULENT BOUNDARY LAYER AT TRANSONIC SPEEDS

A. F. Messiter and T. C. Adamson, Jr. *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 271-279 refs (For primary document see N79-20030 11-02)

(Grant NsG-1326)

Avail: NTIS HC A20/MF A01 CSCL 01A

An asymptotic description is derived for the interaction of a weak normal shock wave and a turbulent boundary layer along a plane wall. In the case studied the nondimensional friction velocity is small in comparison with the nondimensional shock strength, and the shock wave extends well into the boundary layer. Analytical results are described for the local pressure distribution and wall shear, and a criterion for incipient separation is proposed. A comparison of predicted pressures with available experimental data includes the effect of longitudinal wall curvature.

Author

N79-20047*# Flow Research, Inc., Kent, Wash.

RECENT DEVELOPMENTS IN FINITE ELEMENT ANALYSIS FOR TRANSONIC AIRFOILS

M. M. Hafez and E. M. Murman *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 281-296 refs (For primary document see N79-20030 11-02)

(Contract NAS1-14246)

Avail: NTIS HC A20/MF A01 CSCL 01A

The prediction of aerodynamic forces in the transonic regime generally requires a flow field calculation to solve the governing non-linear mixed elliptic-hyperbolic partial differential equations. Finite difference techniques were developed to the point that design and analysis application are routine, and continual improvements are being made by various research groups. The principal limitation in extending finite difference methods to complex three-dimensional geometries is the construction of a suitable mesh system. Finite element techniques are attractive since their application to other problems have permitted irregular mesh elements to be employed. The purpose of this paper is to review the recent developments in the application of finite element methods to transonic flow problems and to report some recent results.

L.S.

N79-20048*# General Dynamics/Convair, San Diego, Calif.

SUPERCRITICAL TESTS OF A SELF-OPTIMIZING, VARIABLE-CAMBER WIND TUNNEL MODEL

Ely S. Levinsky and Richard L. Palko (ARO, Inc.) *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 297-313 refs Sponsored in part by AFFDL, Wright-Patterson AFB (For primary document see N79-20030 11-02)

(Contract N00014-76-C-0742)

Avail: NTIS HC A20/MF A01 CSCL 01A

A testing procedure was used in a 16-foot Transonic Propulsion Wind Tunnel which leads to optimum wing airfoil sections without stopping the tunnel for model changes. Being experimental, the optimum shapes obtained incorporate various three-dimensional and nonlinear viscous and transonic effects not included in analytical optimization methods. The method is a closed-loop, computer-controlled, interactive procedure and employs a Self-Optimizing Flexible Technology wing semispan model that conformally adapts the airfoil section at two spanwise control stations to maximize or minimize various prescribed merit functions subject to both equality and inequality constraints. The model, which employed twelve independent hydraulic actuator systems and flexible skins, was also used for conventional testing. Although six of seven optimizations attempted were at least partially convergent, further improvements in model skin smoothness and hydraulic reliability are required to make the technique fully operational.

L.S.

N79-20049*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

APPLICATION OF NUMERICAL OPTIMIZATION TO THE DESIGN OF ADVANCED SUPERCRITICAL AIRFOILS

Raymond R. Johnson (Vought Corp.) and Raymond M. Hicks *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 315-325 refs (For primary document see N79-20030 11-02)

Avail: NTIS HC A20/MF A01 CSCL 01A

An application of numerical optimization to the design of advanced airfoils for transonic aircraft showed that low-drag sections can be developed for a given design Mach number without an accompanying drag increase at lower Mach numbers. This is achieved by imposing a constraint on the drag coefficient at an off-design Mach number while minimizing the drag coefficient at the design Mach number. This multiple design-point numerical optimization has been implemented with the use of airfoil shape functions which permit a wide range of attainable profiles during the optimization process. Analytical data for the starting airfoil shape, a single design-point optimized shape, and a double design-point optimized shape are presented. Experimental data obtained in the NASA Ames two-by two-foot wind tunnel are also presented and discussed.

L.S.

N79-20050*# McDonnell Aircraft Co., St. Louis, Mo.

IMPROVED PREDICTION OF LAMINAR LEADING EDGE SEPARATION

R. N. Herring and W. L. Ely *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 327-334 refs (For primary document see N79-20030 11-02)

Avail: NTIS HC A20/MF A01 CSCL 01A

Research was conducted to provide a definite criterion for the prediction of the bubble burst on airfoils typical of those used for fighter wings. The approach taken was to correlate existing airfoil bubble burst data using various parameters at the laminar separation point. The method due to Weber was modified to provide a continuous analytic solution for the velocity distribution around the airfoil leading edge. Coupling the modified Weber method with the Stratford laminar separation prediction method leads to a universal chart giving the conditions at

separation as a function of stagnation location and leading edge radius. Application of the combined method to available two-dimensional airfoil data resulted in an empirical criterion presenting the limiting local velocity gradient at separation as a function of the boundary layer momentum thickness at separation for bubble burst. The correlation leads as well to the qualitative explanation of two types of laminar stall: thin airfoil and leading edge. The validity of the correlation is demonstrated by predicting the lift coefficient and angle of attack for stall on airfoils with leading edge or trailing edge flaps. L.S.

N79-20051*# McDonnell Aircraft Co., St. Louis, Mo.
THE PREDICTION OF TWO-DIMENSIONAL AIRFOIL STALL PROGRESSION
Lloyd W. Gross *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 335-345 refs (For primary document see N79-20030 11-02)
Avail: NTIS HC A20/MF A01 CSCL 01A

A generalized boundary condition potential flow calculation method was combined with a momentum integral boundary layer method and a base flow theory of separation to predict airfoil viscous-inviscid interference up to and beyond stall. The resultant program considers laminar and turbulent separation and is, therefore, applicable to thin or thick airfoil stall. The calculated flow field includes the airfoil and the separation bubble recombination region behind the airfoil. Calculated pressure distributions and equivalent airfoil shapes, including the displacement thickness of the viscous regions, are compared with flow field measurements for several airfoils. The measured displacement thicknesses and wake centerlines corroborate the calculated shape. The comparison also suggests the use of the analytical solution to evaluate the measurements. L.S.

N79-20052*# Analytical Methods, Inc., Bellevue, Wash.
APPLICATION OF THE AMI C SUB l SUB max PREDICTION METHOD TO A NUMBER OF AIRFOILS
F. A. Dvorak and B. Maskew *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 347-365 refs (For primary document see N79-20030 11-02)
(Contract DAAG29-76-C-0019)
Avail: NTIS HC A20/MF A01 CSCL 01A

A method for calculating the flow about airfoils up to and beyond the stall is described. It is an iterative procedure between potential flow and boundary layer solutions. The separated region is modeled in the potential flow analysis using free vortex sheets which require an inner iteration to establish their shapes. The free vortex sheet length is an important parameter in the potential flow calculation. Results so far indicate a possible correlation between wake length and airfoil thickness/chord ratio. Calculated and experimental results are compared for a series of airfoils.
Author

N79-20053*# Wichita State Univ., Kans.
A NEW FLOW MODEL FOR HIGHLY SEPARATED AIRFOIL FLOWS AT LOW SPEEDS
Glen W. Zumwalt and Sharad N. Naik *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 367-382 refs (For primary document see N79-20030 11-02)
(Grant NsG-1192)
Avail: NTIS HC A20/MF A01 CSCL 01A

An analytical model for separated airfoil flows is presented which is based on experimentally observed physical phenomena. These include a free stagnation point aft of the airfoil and a standing vortex in the separated region. A computer program is described which iteratively matches the outer potential flow, the airfoil turbulent boundary layer, the separated jet entrainment, mass conservation in the separated bubble, and the rear stagnation pressure. Separation location and pressure are not specified a priori. Results are presented for surface pressure coefficient and compared with experiment for three angles of attack for a GA(W)-1, 17% thick airfoil. Author

N79-20054*# Boeing Commercial Airplane Co., Seattle, Wash.
INVERSE BOUNDARY-LAYER TECHNIQUE FOR AIRFOIL DESIGN
M. L. Henderson *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 383-397 refs (For primary document see N79-20030 11-02)
Avail: NTIS HC A20/MF A01 CSCL 01A

A description is presented of a technique for the optimization of airfoil pressure distributions using an interactive inverse boundary-layer program. This program allows the user to determine quickly a near-optimum subsonic pressure distribution which meets his requirements for lift, drag, and pitching moment at the desired flow conditions. The method employs an inverse turbulent boundary-layer scheme for definition of the turbulent recovery portion of the pressure distribution. Two levels of pressure-distribution architecture are used - a simple roof top for preliminary studies and a more complex four-region architecture for a more refined design. A technique is employed to avoid the specification of pressure distributions which result in unrealistic airfoils, that is, those with negative thickness. The program allows rapid evaluation of a designed pressure distribution off-design in Reynolds number, transition location, and angle of attack, and will compute an airfoil contour for the designed pressure distribution using linear theory. L.S.

N79-20055*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LANGLEY'S TWO-DIMENSIONAL RESEARCH FACILITIES: CAPABILITIES AND PLANS
Edward J. Ray *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 399-414 refs (For primary document see N79-20030 11-02)
Avail: NTIS HC A20/MF A01 CSCL 01A

The current capabilities and the forthcoming plans for Langley's two-dimensional research facilities are described. The characteristics of the Langley facilities are discussed in terms of Reynolds number, Mach number, and angle-of-attack capabilities. Comments are made with regard to the approaches which have been investigated to alleviate typical problem areas such as wall boundary effects. Because of the need for increased Reynolds number capability at high subsonic speeds, a considerable portion of the paper deals with a description of the 20 by 60 cm two-dimensional test section of the Langley 0.3 meter transonic cryogenic tunnel which is currently in the calibration and shakedown phase. L.S.

N79-20056*# Southampton Univ. (England).
DEVELOPMENTS IN TESTING AIRFOIL TECHNIQUES AT UNIVERSITY OF SOUTHAMPTON
Michael J. Goodyer *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 415-423 refs (For primary document see N79-20030 11-02)
(Grant NsG-7172)
Avail: NTIS HC A20/MF A01 CSCL 01A

The evolution in Europe of the flexible walled test section, as applied to two dimensional testing at low and transonic speeds, is traced from its beginnings at NPL, London, in the early 1940's, and is shown to lead logically to the latest version now nearing completion at Southampton University. The principal changes that have taken place are improvements in the methods of choosing wall contours such that they rapidly follow appropriate streamlines, and reductions in the depth of test sections. The latest transonic test section presently under assembly at Southampton has, as its principal new feature, the facility for the automation of wall streamlining with the aid of an on-line computer. The versatility of the flexible walled test section is emphasized by reference to the simulation of alternative flows including cascade, steady pitching in an infinite flowfield, and ground effect. Finally, sources of error in streamlining are identified, with methods for their alleviation. L.S.

N79-20057*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A NEW AIRFOIL RESEARCH CAPABILITY
Charles L. Ladson *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 425-432 refs (For primary document see N79-20030 11-02)
Avail: NTIS HC A20/MF A01 CSCL 01A

The design and construction of a self streamlining wall test section for the Langley 0.3 meter transonic cryogenic tunnel was included in the fiscal year 1978 construction of facilities budget for Langley Research Center. The design is based on the research being carried out by M. J. Goodyer at the University of Southampton, Southampton, England, and is supported by

Langley Research Center. This paper presents a brief description of the project. Included are some of the design considerations, anticipated operational envelope, and sketches showing the detail design concepts. Some details of the proposed operational mode, safety aspects, and preliminary schedule are presented. Author

N79-20058*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESIGN AND CALIBRATION OF SLOTTED WALLS FOR TRANSONIC AIRFOIL WIND TUNNELS
Richard W. Barnwell, William G. Sewall, and Joel L. Everhart *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 433-443 refs (For primary document see N79-20030 11-02)
Avail: NTIS HC A20/MF A01 CSCL 01A

The traditional procedure for estimating the performance of slotted walls for airfoil wind tunnels is reviewed, and a modification which improves the accuracy of this procedure is described. Unlike the traditional procedure, the modified procedure indicates that the design of airfoil wind-tunnel walls which induce minimal blockage and streamline-curvature effects is feasible. The design and testing of such a slotted wall is described. It is shown experimentally that the presence of a model can affect the plenum pressure and thus make the use of the plenum pressure as a calibration reference questionable. Finally, an ONERA experiment which shows the effect of the sidewall boundary layer on the measured model normal force is discussed. Author

N79-20059*# United Technologies Research Center, East Hartford, Conn.
SOME STEADY AND OSCILLATING AIRFOIL TEST RESULTS, INCLUDING THE EFFECTS OF SWEEP, FROM THE TUNNEL SPANNING WING Progress Report
Franklin O. Carta, Arthur O. St.Hilaire, James B. Rorke (United Technologies Corp.), and W. Donald Jepson (United Technologies Corp.) *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 1 1979 p 445-458 refs (For primary document see N79-20030 11-02)
Avail: NTIS HC A20/MF A01 CSCL 01A

A large scale tunnel spanning wing was built and tested. The model can be operated as either a swept or unswept wing and can be tested in steady state or oscillated sinusoidally in pitch about its quarter chord. Data is taken at mid-span with an internal 6-component balance and is also obtained from miniature pressure transducers distributed near the center span region. A description is given of the system and a brief discussion of some of the steady and unsteady results obtained to date. These are the steady load behavior to Mach numbers of approximately 1.1 and unsteady loads, including drag, at a reduced frequency of approximately 0.1. L.S.

N79-20060*# Remtech, Inc., Huntsville, Ala.
JOVIAN PROBE WAKE FLOWFIELD Final Report
Carl D. Engel Mar. 1979 54 p refs
(Contract NAS1-15446)
(NASA-CR-159021) Avail: NTIS HC A04/MF A01 CSCL 01A

The base heating problem in the Jovian probe was examined. The entire wake flowfield is defined to calculate the radiative heating to the base region of the Jovian probe. Engineering tools for calculating the probe's wake flowfield are developed. The near and far viscous and inviscid flowfields for three entry conditions are calculated. The flowfields include pressure, temperature, and species concentration for radiation analysis. A mathematical model used in the calculations is described. The results obtained indicate that temperatures in the Jovian probe range from 4,000 to 10,00 K and pressures range from 10 to 1,000 times the free stream value. S.E.S.

N79-20061*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTATION OF TURBULENT NEAR WAKE FOR ASYMMETRIC AIRFOILS
George S. Deiwert Mar. 1979 16 p refs Presented at the DEA meeting on Viscous and Interacting Flow Field Effects, Meersburg/Bodensee, West Germany, 24-26 Apr. 1979
(NASA-TM-78581; A-7803) Avail: NTIS HC A02/MF A01 CSCL 01A

A numerical procedure for studying the turbulent near wake of two dimensional airfoil sections is presented. The Reynolds Navier-Stokes equations were written for flow about bodies of arbitrary geometry and solved on an arbitrary nonuniform curvilinear computational mesh. Eddy viscosity and Reynolds stress turbulence transport models are considered. Specific examples are shown for airfoil section by using an algebraic viscosity model with streamwise relaxation and the interactive Reynolds stress model. S.E.S.

N79-20062*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTAL AERODYNAMIC CHARACTERISTICS AT MACH NUMBERS FROM 0.60 TO 2.70 OF TWO SUPERSONIC CRUISE FIGHTER CONFIGURATIONS
Samuel M. Dollyhigh Feb. 1979 190 p
(NASA-TM-78764; L-12426) Avail: NTIS HC A09/MF A01 CSCL 01A

Two 0.085-scale full span wind-tunnel models of a Mach 1.60 design supercruiser configuration were tested at Mach numbers from 0.60 to 2.70. One model incorporated a varying dihedral (swept-up) wing to obtain the desired lateral-directional characteristics; the other incorporated more conventional twin vertical tails. The data from the wind-tunnel tests are presented without analysis. Author

N79-20063*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUBSONIC LONGITUDINAL AND LATERAL AERODYNAMIC CHARACTERISTICS FOR A SYSTEMATIC SERIES OF STRAKE-WING CONFIGURATIONS
James M. Luckring Feb. 1979 219 p refs
(NASA-TM-78642) Avail: NTIS HC A10/MF A01 CSCL 01A

A systematic wind tunnel study was conducted in the Langley 7 by 10 foot high speed tunnel to help establish a parametric data base of the longitudinal and lateral aerodynamic characteristics for configurations incorporating strake-wing geometries indicative of current and proposed maneuvering aircraft. The configurations employed combinations of strakes with reflexed planforms having exposed spans of 10%, 20%, and 30% of the reference wing span and wings with trapezoidal planforms having leading edge sweep angles of approximately 30, 40, 44, 50, and 60 deg. Tests were conducted at Mach numbers ranging from 0.3 to 0.8 and at angles of attack from approximately -4 to 48 deg at zero sideslip. J.A.M.

N79-20064*# Computational Mechanics Consultants, Knoxville, Tenn.
NUMERICAL PREDICTION OF THREE-DIMENSIONAL JUNCTURE REGION FLOW USING THE PARABOLIC NAVIER-STOKES EQUATIONS Final Report
A. J. Baker, P. D. Manhardt, and J. A. Orzechowski Mar. 1979 71 p refs
(Contract NAS1-14307)
(NASA-CR-159024; CoMoC-78TR-3) Avail: NTIS HC A04/MF A01 CSCL 01A

A numerical solution algorithm is established for prediction of subsonic turbulent three-dimensional flows in aerodynamic configuration juncture regions. A turbulence closure model is established using the complete Reynolds stress. Pressure coupling is accomplished using the concepts of complementary and particular solutions to a Poisson equation. Specifications for data input juncture geometry modification are presented. S.E.S.

N79-20065*# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
NUMERICAL DESIGN OF SHOCKLESS AIRFOILS Final Technical Report, 1 Sep. 1970 - 28 Feb. 1979
Paul R. Garabedian 28 Feb. 1979 8 p refs
(Grant NGR-33-016-167)
(NASA-CR-158439) Avail: NTIS HC A02/MF A01 CSCL 01A

An attempt is made to indicate and briefly discuss only the most significant achievements of the research. The most successful contribution from the contract was the code for two dimensional analysis of airfoils in transonic flow. G.Y.

N79-20066*# Old Dominion Univ. Research Foundation, Norfolk, Va.

LAMINAR AND TURBULENT FLOWS OVER SPHERICALLY BLUNTED CONE AND HYPERBOLOID WITH MASSIVE SURFACE BLOWING Progress Report, 1 May - 31 Oct. 1978

Ajay Kumar and S. N. Twari Jan. 1979 48 p refs
(Grant NsG-1464)
(NASA-CR-158437) Avail: NTIS HC A03/MF A01 CSCL 01A

Numerical solutions are presented for the flow over a spherically blunted cone and hyperboloid with massive surface blowing. Time-dependent viscous shock-layer equations are used to describe the flow field. The boundary conditions on the body surface include a prescribed blowing-rate distribution. The governing equations are solved by a time-asymptotic finite-difference method. Results presented here are only for a perfect gas-type flow at zero angle of attack. Both laminar and turbulent flow solutions are obtained. It is found that the effect of the surface blowing on the laminar flow field is to smooth out the curvature discontinuity at the sphere-cone juncture point, which results in a positive pressure gradient over the body. The shock slope increases on the downstream portion of the body as the surface blowing rate is increased. The turbulent flow with surface blowing is found to redevelop a boundary-layer-like region near the surface. The effects of this boundary-layer region on the flow field and heating rates are discussed. Author

N79-20067*# Rockwell International Corp., Downey, Calif.
PREDICTION OF ORBITER RSI TILE GAP HEATING RATIOS FROM NASA/AMES DOUBLE WEDGE MODEL TEST

3 Apr. 1978 85 p refs
(Contract NAS9-14000)
(NASA-CR-160147; SEH-ITA-78-047) Avail: NTIS HC A05/MF A01 CSCL 20D

In-depth gap heating ratios for Orbiter RSI tile sidewalls were predicted based on near steady state temperature measurements obtained from double wedge model tests. An analysis was performed to derive gap heating ratios which would result in the best fit of test data; provide an assessment of open gap response, and supply the definition of gap filler requirements on the Orbiter. A comparison was made of these heating ratios with previously derived ratios in order to verify the extrapolation of the wing glove data to Orbiter flight conditions. The analysis was performed with the Rockwell TPS Multidimensional Heat Conduction Program for a 3-D, 2.0-inch thick flat RSI tile with 255 nodal points. The data from 14 tests was used to correlate with the analysis. The results show that the best-fit heating ratios at the station farthest upstream on the model for most gap depths were less than the extrapolated values of the wing glove model heating ratios. For the station farthest downstream on the model, the baseline heating ratios adequately predicted or over-predicted the test data. Author

N79-20068*# Rockwell International Corp., Downey, Calif.
PREDICTION OF IN-DEPTH GAP HEATING RATIOS FROM WING GLOVE MODEL TEST DATA

3 Nov. 1977 57 p refs
(Contract NAS9-14000)
(NASA-CR-160146; SEH-ITA-77-245) Avail: NTIS HC A04/MF A01 CSCL 20D

In-depth gap heating ratios were predicted down RSI tile sidewalls based on temperature measurements obtained from the JSC arc-jet Wing Glove model tests in order to develop gap heating ratios which resulted in the best possible fit of test data and to produce a set of engineering verification heating ratios similar in shape to one another which could be used at various body points on the Orbiter during reentry. The Rockwell TPS Multidimensional heat conduction program was used to perform 3-D thermal analyses using a 3.0 in. thick section of a curved RSI tile with 283 nodal points. Correlation with test data shows that the predicted heating ratios were significatnly higher down in the gap than the zero pressure values for T/C stacks 39 and 38 on the Wing Glove model. For stack 37 (in a low pressure region), the baseline heating ratio overpredicted the temperature data. This analysis, which showed that the heating ratios were a strong function of the product of pressure and pressure gradient, will be used to compare with recent Gap/Step and Ames Double Wedge test/analysis results in the effort to identify the Orbiter gap response to high delta P flight environment. A.R.H.

N79-20069*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIND TUNNEL PERFORMANCE OF FOUR ENERGY EFFICIENT PROPELLERS DESIGNED FOR MACH 0.8 CRUISE

Robert J. Jeracki, Daniel C. Mikkelson, and Bernard J. Blaha 1979 24 p refs Presented at the Business Aircraft Meeting, Wichita, Kansas, 3-6 Apr. 1979; sponsored by the Soc. of Automotive Engr.
(NASA-TM-79124; E-9960) Avail: NTIS HC A02/MF A01 CSCL 01A

Several advanced aerodynamic and acoustic concepts were investigated in recent wind tunnel tests performed in the NASA-Lewis Research Center 8x6 foot wind tunnel. These concepts included aerodynamically integrated propeller/nacelles, area-ruling, blade sweep, reduced blade thickness, and power (disk) loadings several times higher than conventional designs. Four eight-bladed propeller models were tested to determine aerodynamic performance. Relative noise measurements were made on three of the models at cruise conditions. Three of the models were designed with swept blades and one with straight blades. At the design Mach number of 0.8, power coefficient of 1.7, and advance ratio of 3.06, the straight bladed model had the lowest net efficiency of 75.8 percent. Increasing the sweep to 30 deg improved the performance to near 77 percent. Installation of an area-ruled spinner on a 30 deg sweep model further improved the efficiency to about 78 percent. The model with the highest blade sweep (45 deg) and an area-ruled spinner had the highest net efficiency of 78.7 percent, and at lower power loadings the efficiency exceeded 80 percent. At lower Mach numbers the 30 deg swept model had the highest efficiency. Values near 81 percent were obtained for the design loading at speeds to Mach 0.7. Relative noise measurements indicated that the acoustically designed 45 deg sweep model reduced the near field cruise noise by between 5 and 6 dB. A.R.H.

N79-20070*# Rockwell International Corp., Los Angeles, Calif.
STUDY OF THE APPLICATION OF SUPERPLASTICALLY FORMED AND DIFFUSION BONDED (SPF/DC) TITANIUM STRUCTURE TO LAMINAR FLOW CONTROL (LFC) WING DESIGN

F. T. McQuilkin Jan. 1979 101 p refs
(Contract NAS1-14566)
(NASA-CR-158979; NA-77-1142) Avail: NTIS HC A06/MF A01 CSCL 01A

Eighteen design concepts for a LFC wing cover, using various SPF/DB approaches, were developed. After evaluation of producibility, compatibility with LFC requirements, structural efficiency and fatigue requirements, three candidates were selected for fabrication of demonstration panels. Included were both sandwich and stiffened semi-sandwich panels with slotted and perforated surfaces. Subsequent to the evaluation of the three demonstration panels, one concept was selected for fabrication of a 0.3 x 1.0 meter (12 x 42 inch) feasibility panel. It was a stiffened, semi-sandwich panel with a slotted surface, designed to meet the requirements of the upper wing cover at the maximum wing bending moment of the baseline configuration. S.E.S.

N79-20071*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DETERMINATION OF STABILITY AND CONTROL PARAMETERS OF A LIGHT AIRPLANE FROM FLIGHT DATA USING TWO ESTIMATION METHODS

Vladislav Klein Mar. 1979 102 p refs
(NASA-TP-1306; L-12291) Avail: NTIS HC A06/MF A01 CSCL 01A

Two identification methods, the equation error method and the output error method, are used to estimate stability and control parameter values from flight data for a low-wing, single-engine, general aviation airplane. The estimated parameters from both methods are in very good agreement primarily because of sufficient accuracy of measured data. The estimated static parameters also agree with the results from steady flights. The effect of power different input forms are demonstrated. Examina-

tion of all results available gives the best values of estimated parameters and specifies their accuracies. Author

N79-20072*# Boeing Commercial Airplane Co., Seattle, Wash.
REDUCTION OF COMPUTER USAGE COSTS IN PREDICTING UNSTEADY AERODYNAMIC LOADINGS CAUSED BY CONTROL SURFACE MOTIONS: ANALYSIS AND RESULTS Final Report
W. S. Rowe, J. D. Sebastian, and J. R. Petrarca Mar. 1979 85 p refs
(Contract NAS1-14122)
(NASA-CR-3009) Avail: NTIS HC A05/MF A01 CSCL 01A

Results of theoretical and numerical investigations conducted to develop economical computing procedures were applied to an existing computer program that predicts unsteady aerodynamic loadings caused by leading and trailing edge control surface motions in subsonic compressible flow. Large reductions in computing costs were achieved by removing the spanwise singularity of the downwash integrand and evaluating its effect separately in closed form. Additional reductions were obtained by modifying the incremental pressure term that account for downwash singularities at control surface edges. Accuracy of theoretical predictions of unsteady loading at high reduced frequencies was increased by applying new pressure expressions that exactly satisified the high frequency boundary conditions of an oscillating control surface. Comparative computer result indicated that the revised procedures provide more accurate predictions of unsteady loadings as well as providing reduction of 50 to 80 percent in computer usage costs. J.A.M.

N79-20073# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
UNSTEADY TRANSONIC FLOW IN TWO-DIMENSIONAL CHANNELS Final Report, 15 May - 1 Oct. 1978
T. C. Adamson, Jr. and M. S. Liou Oct. 1978 41 p refs
(Contract N00019-77-C-0263)
(AD-A062311; UMICH-015411-F) Avail: NTIS HC A03/MF A01 CSCL 20/4

Unsteady transonic flow with a shock wave in a two-dimensional channel is considered. Solutions valid in a thin inner region enclosing the nozzle throat, where previous solutions showed singular behavior, are presented. A brief description of a computer movie is given; this movie shows solutions for unsteady transonic channel flow for two different cases in which the shock wave, as a result of pressure oscillations impressed downstream of the nozzle throat, moves to and upstream of the throat, disappears, and reforms at the throat. An analysis showing how results derived for the interaction between a shock wave and a turbulent boundary layer in steady flow may be used in the corresponding quasi-steady flow problem, is presented; a discussion of how these results may be used to deduce the order of the distance from the shock wave to the separation point and the time characteristic of the life of a shock induced separation bubble in unsteady flow is given.
Author (GRA)

N79-20074# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 4G: ONE-THIRD OCTAVE BAND SPECTROGRAMS OF WAKE SPLIT-FILM DATA, FAIRINGS AND SURFACE DEVICES Final Report, Mar. 1977 - Feb. 1978
Philip F. Sheridan Sep. 1978 352 p
(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)
(AD-A063000; USARTL-TR-78-23D) Avail: NTIS HC A16/MF A01 CSCL 01/3

This is the seventh of the seven sub-volumes of Volume 4 containing one-third octave band spectrographs of the model helicopter hub/rotor wake as it was modified by various aerodynamic devices. This sub-volume deals with the effects of various fairings and also of surface devices. Author (GRA)

N79-20075# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 6-C: ONE-THIRD OCTAVE BAND SPECTROGRAMS OF WAKE SINGLE FILM DATA, HUBCAPS AND AIR EJECTORS Final Report, 15 Mar. 1977 - 13 Feb. 1978
Philip F. Sheridan Sep. 1978 382 p
(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)
(AD-A062140; USARTL-TR-78-23F-V-6-C) Avail: NTIS HC A17/MF A01 CSCL 01/3

This is the third of the three volumes of Volume 6 containing one-third octave band spectrographs of the model helicopter hub/rotor wake velocities derived from the single-film velocity transducer data. This sub-volume deals with the effects of hub caps and air ejector systems on wake velocities. Author (GRA)

N79-20076# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 7-A: FREQUENCY ANALYSES OF WAKE SPLIT-FILM DATA, BUILDUP TO BASELINE Final Report, 15 Mar. 1977 - 13 Feb. 1978
Philip F. Sheridan Sep. 1978 210 p
(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)
(AD-A062639; USARTL-TR-78-23G-Vol-7A) Avail: NTIS HC A11/MF A01 CSCL 01/3

This is the first of seven sub-volumes of Volume 7 containing spectrographs of the model helicopter hub/rotor wake as it was modified by various aerodynamic devices. This sub-volume deals with the wake changes as the model is built up to baseline configuration. Author (GRA)

N79-20077# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 7C: FREQUENCY ANALYSES OF WAKE SPLIT-FILM DATA, SOLID HUBCAPS Final Report, 15 Mar. 1977 - 13 Feb. 1978
Philip F. Sheridan Sep. 1978 251 p
(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)
(AD-A062640; USARTL-TR-78-23G-Vol-7C) Avail: NTIS HC A12/MF A01 CSCL 01/3

This is the third of seven sub-volumes of Volume 7 containing spectrographs of the model helicopter hub/rotor wake as it was modified by various aerodynamic devices. This sub-volume deals with the effects of solid hub caps. Here the cap underside is flat and does not share the upperside camber as with the open caps. Author (GRA)

N79-20078# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 7-D: FREQUENCY ANALYSES OF WAKE SPLIT-FILM DATA, OPEN HUBCAPS Final Report, 15 Mar. 1977 - Feb. 1978
Philip F. Sheridan Sep. 1978 400 p
(Contract DAAJ02-77-C-0020)
(AD-A062641; USARTL-TR-78-23G-Vol-7D) Avail: NTIS HC A17/MF A01 CSCL 01/3

This is the fourth of seven sub-volumes of Volume 7 containing spectrographs of the model helicopter hub/rotor wake as it was modified by various aerodynamic devices. This sub-volume deals with the effects of various open hub caps. Open caps have parallel undersides and uppersides. Author (GRA)

N79-20079# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION, VOLUME 7-E. FREQUENCY ANALYSES OF WAKE SPLIT-FILM DATA, AIR EJECTORS Final Report, 15 Mar. 1977 - 13 Feb. 1978
Philip F. Sheridan Sep. 1978 397 p
(Contract DAAJ02-77-C-0020)
(AD-A062590; USARTL-TR-78-23G-Vol-7-E) Avail: NTIS HC A17/MF A01 CSCL 01/3

This is the fifth of seven sub-volumes of Volume 7 containing spectrographs of the model helicopter hub/rotor wake as it was modified by verious aerodynamic devices. This sub-volume deals with the effects of various air ejector systems on the wake.
Author (GRA)

N79-20080# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 7-F: FREQUENCY ANALYSES OF WAKE SPLIT-FILM DATA, AIR EJECTORS WITH HUBCAPS Final Report, 15 Mar. 1977 - 13 Feb. 1978
Philip F. Sheridan Sep. 1978 230 p

(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)
(AD-A062117; USARTL-TR-78-23G-Vol-7F) Avail: NTIS
HC A11/MF A01 CSCL 01/3

This is the sixth of seven sub-volumes of Volume 7 containing spectrographs of the model helicopter hub/rotor wake as it was modified by various aerodynamic devices. This sub-volume deals with the effects of air ejector systems in configurations already possessing hub caps and also effects of several wing configurations mounted variously to alter the wake. Author (GRA)

N79-20081# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 7-G: FREQUENCY ANALYSES OF WAKE SPLIT-FILM DATA, FAIRINGS AND SURFACE DEVICES Final Report, 15 Mar. 1977 - 13 Feb. 1978
Philip F. Sheridan Sep. 1978 344 p
(Contract DAAJ02-77-C-0020)
(AD-A062642; USARTL-TR-78-23G-Vol-7G) Avail: NTIS
HC A15/MF A01 CSCL 01/3

This is the seventh sub-volumes of Volume 7 containing spectrographs of the model helicopter hub/rotor wake as it was modified by various aerodynamic devices. This sub-volume deals with the effects of various fairings and also of surface devices. Author (GRA)

N79-20082# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMIC OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 8-A: FREQUENCY ANALYSES OF WAKE SINGLE FILM DATA, BUILDUP TO BASELINE Final Report, 15 Mar. 1977 - 13 Feb. 1978
Philip F. Sheridan Sep. 1978 291 p refs
(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)
(AD-A062254; USARTL-TR-78-23H) Avail: NTIS
HC A13/MF A01 CSCL 01/3

This is the first of the three volumes of Volume 8 containing frequency spectrographs of the model helicopter hub/rotor wake velocities from the single-film velocity transducer data. This sub-volume deals with the wake changes as the model is built up to the baseline configuration. Author (GRA)

N79-20083# Naval Research Lab., Washington, D. C.
THE INFLUENCE OF YAW ANGLE UPON THE VORTEX WAKES OF STATIONARY AND VIBRATING CYLINDERS Final Report
Steven E. Ramberg Aug. 1978 119 p refs
(AD-A062417; AD-E000238; NRL-MR-3822) Avail: NTIS
HC A06/MF A01 CSCL 20/4

This report investigates the influences of yaw angle and end condition upon the vortex wakes of finite-length, yawed circular cylinders. The standard for comparison is the Independence Principle which produces the so-called Cosine Laws for yawed body flows. These expressions have found widespread use even though their validity cannot be proved theoretically for separated, unsteady or turbulent flows. Many previous empirical checks of the Principle under these conditions have produced conflicting reports. Measurements of the vortex shedding frequency, the shedding angle, the base pressure, the vortex formation length and the wake width were obtained for both stationary and vibrating yawed cylinders in the range of Reynolds numbers Re = 160 to 1100. The influence of end conditions was assessed for free-ended cylinders of varying end geometries and for cylinders fitted with adjustable endplates. The cylinder lengths varied from about 20 to nearly 100 diameters. Based upon the experimental results and upon some fundamental considerations of the vorticity discharged at separation it is concluded that the use of the Independence Principle is not valid for separated, yawed cylinder flows except in two special cases. For the first time the 'universal' Strouhal number concept for scaling the vortex wakes of bluff bodies at normal incidence is found to be valid for inclined cylinders. GRA

N79-20084# McDonnell-Douglas Corp., St. Louis, Mo.
LIFT SYSTEM INDUCED AERODYNAMICS OF V/STOL AIRCRAFT IN A MOVING DECK ENVIRONMENT. VOLUME 2. STATIC AND DYNAMIC JET-INDUCED FORCE AND MOMENT DATA Final Report, 30 Sep. 1977 - 29 Sep. 1978
James H. Kamman and Charles L. Hall 29 Sep. 1978 773 p
(Contract N62269-77-C-0365)
(AD-A062097; NADC-77107-30-Vol-2) Avail: NTIS
HC A99/MF A01 CSCL 01/2

The propulsive lift system induced aerodynamics of multi-jet V/STOL aircraft configurations were experimentally evaluated over a moving deck and at static hover conditions. Several model configurations representative of advanced subsonic and supersonic V/STOL aircraft were tested. Dynamic jet-induced force and moment data were obtained for heaving, pitching, and rolling motions of a simulated seaborne landing platform over a range of heights, amplitudes, and frequencies. Configuration effects were assessed at both static hover and deck motion conditions, including the effects of wing height, fuselage contouring, lift improvement devices, and nozzle arrangement. In addition, tests were performed to separate the effects of deck motion on the fountain impingement forces. Empirical procedures were defined to aid in predicting the dynamic jet-induced forces and moment variations with deck motion. Configuration design and model testing guidelines for V/STOL aircraft are described. Recommendations are also made for further research to provide additional information required to develop generalized prediction procedures. Author (GRA)

N79-20085# Pennsylvania State Univ., University Park. Applied Research Lab.
ACOUSTIC EFFICIENCY OF BOUNDARY-LAYER TRANSITION
G. C. Lunchle 7 Nov. 1978 16 p refs
(Contract N00017-73-C-1418)
(AD-A062171; TM-78-285) Avail: NTIS HC A02/MF A01
CSCL 20/4

The radiated noise due to incompressible boundary-layer transition on an infinite, rigid planar surface has been recently analyzed (ARL TM 78-204, 28 July 1978). The results of that analysis are the power spectrum and directivity of the farfield sound pressure due to a unit span of transition zone flow. In this note, we further analyze transition zone flow noise by deriving an expression for the acoustic efficiency. We compare this efficiency with the acoustic efficiency of a fully-developed turbulent boundary layer and find that the radiation from the transition zone is considerably more efficient. In particular, for typical values of the Reynolds numbers upon which this comparison depends, transition zone radiation is approximately a thousand times more efficient. Author (GRA)

N79-20086# Calspan Advanced Technology Center, Buffalo, N. Y.
A STUDY OF INLET CONDITIONS FOR THREE-DIMENSIONAL TRANSONIC COMPRESSOR FLOWS Final Report, 1 Jun. 1977 - 31 May 1978
William J. Rae and John A. Lordi Jun. 1978 66 p refs
(Contract N00019-77-C-0363)
(AD-A062688; CALSPAN-XE-6129-A-4) Avail: NTIS
HC A04/MF A01 CSCL 20/4

This report contains a study of the conditions at the inlet of a transonic compressor, with special reference to the formulation of these conditions in a manner suitable for flowfield computation. Several candidate methods for specifying the inlet conditions are reviewed, and details are given for a procedure that uses a matching between finite-difference results and linear-theory formulas at a plane upstream of the rotor. Author (GRA)

N79-20087# Advisory Group for Aerospace Research and Development, Paris (France).
UNSTEADY VISCOUS THIN AIRFOIL THEORY
John E. Yates (Aeronautical Res. Associates of Princeton, Inc., N. J.) Jan. 1979 24 p refs Presented at 47th Structures and Mater. Panel Meeting, Florence, Sep. 1978
(AGARD-R-671; ISBN-92-835-1306-1) Avail: NTIS
HC A02/MF A01

The concept of viscous thin airfoil theory introduced is formulated for unsteady incompressible flow. The theory is developed for a flat plate airfoil with no thickness boundary layer. Results indicate that the viscous pressure-downwash kernel function has a logarithmic singularity in contrast to the Cauchy singularity of inviscid theory. It is shown by direct numerical solution that for Reynolds number greater than 1000 the viscous

and inviscid results are virtually the same except in the immediate vicinity of the trailing edge. The pressure loading is greater than inviscid theory would indicate and the phase of the complex loading is less than inviscid theory. The effect of edge bluntness is demonstrated for the case of steady flow. S.E.S.

N79-20088# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
A COMPARISON OF PANEL METHODS FOR SUBSONIC FLOW COMPUTATION
H. S. Sytsma (National Aerospace Lab., Amsterdam), B. L. Hewitt (British Aerospace, Lancaster, United Kingdom), and P. E. Rubbert (Boeing Military Airplane Development, Seattle) Feb. 1979 89 p refs
(AGARD-AG-241; ISBN-92-835-1312-6) Avail: NTIS HC A05/MF A01

A data base for a number of relatively simple wing configurations and nacelle configurations is presented. The data results were obtained from the Roberts (BAe) Spline-Neumann Program and a pilot version of the Boeing Advanced Panel-Type Influence Coefficient Method. In addition, results from the practical, engineering type application of several methods are compared with the data solutions. These comparisons suggest that of the methods considered the Boeing Advanced Panel-Type Influence Coefficient Method is the most efficient, in terms of accuracy/computation time ratio. J.M.S.

N79-19990*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PARAMETRIC EXPERIMENTAL STUDY OF THE SLOTTED-WALL BOUNDARY CONDITION
Joel L. Everhart and Richard W. Barnwell *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 459-471 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01A

N79-19995*# Notre Dame Univ., Ind.
VISUALIZATION OF THE SEPARATION AND SUBSEQUENT TRANSITION NEAR THE LEADING EDGE OF AIRFOILS
Anthony V. Arena and Thomas J. Mueller *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 527-538 refs (For primary document see N79-19989 11-01) (Grant NsG-1419)
Avail: NTIS HC A14/MF A01 CSCL 01A

N79-19998*# Owen (F. K.), Palo Alto, Calif.
APPLICATIONS OF DYNAMIC MEASUREMENT TECHNIQUES TO WIND-TUNNEL TESTING
F. K. Owen *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 571-588 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01A

N79-20000*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
SECTION DRAG COEFFICIENTS FROM PRESSURE PROBE TRANSVERSES OF A WING WAKE AT LOW SPEEDS
Lawrence C. Montoya, Paul F. Bikle (Soaring Society of America), and Richard D. Banner *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 601-621 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01A

N79-20003*# Boeing Commercial Airplane Co., Seattle, Wash.
A PROCEDURE FOR ANALYZING TRANSONIC FLOW OVER HARMONICALLY OSCILLATING AIRFOILS
Warren H. Weatherill, F. Edward Ehlers, and James D. Sebastian *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 657-670 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01A

N79-20005*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOME CALCULATIONS OF TRANSONIC POTENTIAL FLOW FOR THE NACA 64A006 AIRFOIL WITH OSCILLATING FLAP
Robert M. Bennett and Samuel R. Bland *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 689-700 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01A

N79-20007*# General Dynamics/Convair, San Diego, Calif.
TRANSONIC FLOW OVER THE NACA 64A006 WITH AN OSCILLATING FLAP-CALCULATIONS BASED ON THE EULER EQUATIONS
R. J. Magnus *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 717-728 refs (For primary document see N79-19989 11-01)
(Contract F33615-76-C-3018)
Avail: NTIS HC A14/MF A01 CSCL 01A

N79-20977# European Space Agency, Paris (France).
VISCOUS-INVISCID FLOW MATCHING: NUMERICAL METHOD AND APPLICATIONS TO TWO-DIMENSIONAL, TRANSONIC AND SUPERSONIC FLOWS
Jean-Claude LeBalleur *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-2 (ESA-TT-496) Nov. 1978 p 26-48 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-2, Mar.-Apr. 1978 p 65-76 Original report in FRENCH previously announced as A78-38698 (For primary document see N79-20974 11-99)
Avail: NTIS HC A05/MF A01

N79-20984# European Space Agency, Paris (France).
LINEARIZED THEORY OF THE PLANE, UNSTEADY, SUPERSONIC FLOW THROUGH A CASCADE
Pierre Salaun *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-3 (ESA-TT-522) Dec. 1979 p 65-85 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 125-132 Original report in FRENCH previously announced as A78-47347 (For primary document see N79-20980 11-99)
Avail: NTIS HC A06/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N79-20089*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SIMULATION STUDY TO EVALUATE A CONSTANT-GROUNDSPEED APPROACH METHOD IN MODERATE AND SEVERE WIND SHEARS
Wendell W. Kelley Mar. 1979 51 p refs
(NASA-TM-80060) Avail: NTIS HC A04/MF A01 CSCL 01C

The use of a constant-groundspeed procedure for flying final approaches in moderate and severe wind shear environments was investigated. Performance was compared to results of simulated constant-airspeed approaches in identical wind profiles. The simulation model was a medium twin-jet transport equipped with an autothrottle for maintaining constant groundspeed or constant airspeed. For both moderate and severe wind shears, the constant-groundspeed approach method was shown to provide a way to more safely negotiate the shears while also providing predictable and acceptable touchdown performance. Results showed airspeeds on final approach to be considerably higher using the constant-groundspeed method, which supplied the additional stall margin needed when tail-wind shears were encountered. Throttle movements were noticeably reduced in all wind profiles when constant-groundspeed approaches were flown. Touchdown conditions were practically identical for both approach methods in moderate wind shear. J.M.S.

N79-20090# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: NORTH CENTRAL AIRLINES, INC., CONVAIR 580, N4825C, KALAMAZOO MUNICIPAL AIRPORT, KALAMAZOO, MICHIGAN, JULY 25, 1978

22 Feb. 1979 47 p
(NTSB-AAR-79-4) Avail: NTIS HC A03/MF A01

At 0702 e.d.t. on July 25, 1978, a North Central Airlines, Inc., Convair 580, operating as Flight 801, crashed after takeoff from Kalamazoo Municipal Airport, Kalamazoo, Michigan. Just as the aircraft passed V1, a bird struck the left engine, and the left propeller autofeathered as the aircraft lifted off. The aircraft turned to the left and flew for 1 minute 19 seconds before it crashed into a cornfield. There were 40 passengers, including an infant, and a crew of 3 on board the aircraft. One crewmember and two passengers were injured seriously. The National Transportation Safety Board determined that the probable cause of this accident was the failure of the captain to follow the prescribed engine-out procedures during instrument meteorological conditions, which allowed the aircraft to decelerate into a flight regime from which he could not recover. Contributing to the accident were inadequate cockpit coordination and discipline. Author

N79-20091# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.
AIRCRAFT ACCIDENT REPORT: E.S.M. GROUP, INC., CESSNA CITATION, N51MW AND NORTH CENTRAL AIRLINES, INC., DC-9-30, N957N LAGUARDIA AIRPORT, FLUSHING, NEW YORK, 21 JUNE 1978
22 Feb. 1979 18 p
(NTSB-AAR-79-3) Avail: NTIS HC A02/MF A01

About 2149 e.d.t., on June 21, 1978, at La Guardia Airport, Flushing, New York, E.S.M. Group, Inc., Cessna Citation, N51MW, almost collided with a North Central Airlines, Inc., DC-9-30, N957N, as the Cessna attempted to take off from runway 13. Shortly after the local controller had cleared the Cessna for takeoff, the DC-9, which had been cleared by the ground controller to taxi northwest on the active runway, turned on to runway 13. The pilot of the Cessna saw the DC-9, rejected the takeoff, steered his airplane off the runway, and avoided a collision. Although there were no injuries to the occupants of either aircraft and the DC-9 was not damaged, the Cessna was damaged slightly. Thunderstorms throughout New York Air Route Traffic Control Center's airspace had caused air traffic delays. Because of these delays the taxiways, ramps, and gates at La Guardia Airport were congested with aircraft. The National Transportation Safety Board determined the probable cause of the incident was the failure of the ground and local controller in the La Guardia tower to effect the required coordination before using the active runway for taxiing an aircraft. Also contributing to the incident was a coordination procedure which did not require the local controller to establish direct communication with the pilot of the aircraft before clearing him to use the active runway for extended taxi operations. Author

N79-20092# Computer Sciences Corp., Trevose, Pa.
ESCAPE SYSTEM TRAJECTORY SENSITIVITY ANALYSIS Final Report
John J. Piacentino, James F. McEnerny, and Gene C. Eberly
1 Aug. 1978 127 p
(Contract N62269-75-C-0001)
(AD-A062429; NADC-77100-40) Avail: NTIS HC A07/MF A01 CSCL 01/3

Several modeling changes were performed on existing Trajectory Simulation Computer Programs to simulate the operation of various escape systems. A study was conducted to identify significant input parameters and the models response to variations in the parameter values. A performance envelope plot was derived for each escape system by considering large deviations in the values of these parameters from their base values. Author (GRA)

N79-20093# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
PRELIMINARY INVESTIGATION OF THE SEATED HEIGHT LIMIT FOR SAFE THROUGH-THE-CANOPY EJECTION FROM THE CT-114 AIRCRAFT
I. Noy Nov. 1978 11 p
(AD-A062403; DCIEM-TR-78X37) Avail: NTIS HC A02/MF A01 CSCL 06/14

In a number of ejections from the CT 114 aircraft, the canopies have failed to jettison. The potential for head or neck injuries exists if the helmet were to contact the canopy ahead of the canopy breaker. A study was conducted to determine the seated height limit for safe through-the-canopy ejections, and the number of pilots whose seated height exceeds the safe seated height. The study involved correlating the seated heights of a number of subjects with static measurements, taken in a CT 114 ejection seat, of the vertical distance between the top of their helmets and the canopy breaker. The safe seated height was found to be 88.0 cm. for dual visor helmets, and 90.6 cm. for the helmet shell alone. These limits would cut off about 75% and 45% of the pilots respectively. It is recommended that further studies be conducted to determine what effect the actual shape of the canopy may have on the safe seated height, and what effect the ejection forces have on pilot's seated height during the first moments of ejection. Author (GRA)

N79-20094# Boeing Vertol Co., Philadelphia, Pa.
SIMULATION CORRELATION, AND ANALYSIS OF THE STRUCTURAL RESPONSE OF A CH-47A TO CRASH IMPACT Final Report, Mar. 1976 - Feb. 1978
Y. V. BadriNath Aug. 1978 297 p refs
(Contract DAAJ02-76-C-0015; DA Proj. 1F2-62209-AH-76)
(AD-A062643; D210-11354-1) Avail: NTIS HC A13/MF A01 CSCL 01/3

The purpose of this effort was to model the dynamic response of the CH-47A helicopter to a crash impact using program KRASH and to correlate the results with data from a CH-47A crash impact test. An improved version of KRASH developed at Boeing Vertol was used for this purpose. This report contains details of the development of a CH-47A KRASH structural model, the pretest predictions, and the description of the CH-47A crash impact test data. Post-test improvements to the structural model to improve correlation with test data are discussed. Problems related to the computer program which arose during the course of the simulation and correlation efforts are discussed in detail. It is concluded that the use of KRASH for simulation of the dynamic response of helicopters to crash impact is currently limited. It is recommended that KRASH be improved in order for it to be useful as a design tool for the analysis of structural crashworthiness. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N79-20095*# Ohio Univ., Athens. Avionics Engineering Center.
ANALYSIS AND DESIGN OF A SECOND-ORDER DIGITAL PHASE-LOCKED LOOP
Paul R. Blasche Mar. 1979 40 p refs
(Grant NGR-36-009-017)
(NASA-CR-158383; TM-66) Avail: NTIS HC A03/MF A01 CSCL 17G

A specific second-order digital phase-locked loop (DPLL) was modeled as a first-order Markov chain with alternatives. From the matrix of transition probabilities of the Markov chain, the steady-state phase error of the DPLL was determined. In a similar manner the loop's response was calculated for a fading input. Additionally, a hardware DPLL was constructed and tested to provide a comparison to the results obtained from the Markov chain model. In all cases tested, good agreement was found between the theoretical predictions and the experimental data. Author

N79-20096*# Ohio Univ., Athens. Avionics Engineering Center.
ACTIVE ANTENNA FOR THE VLF TO HF OBSERVER
R. W. Burhans Feb. 1979 10 p ref

(Grant NGR-36-009-017)
(NASA-CR-158384; TM-65) Avail: NTIS HC A02/MF A01 CSCL 17G

A simple and low cost method of fabricating an active antenna preamplifier system covering the range of 10 KHz to 10 MHz for use with tunable communications receivers is described. The same type of system can be used with airborne VLF navigation receivers. By operating a high impedance preamplifier as a wide band device directly at the base of a short vertical antenna, the signal can be driven back to the receiver on a length of coaxial cable. The antenna can be as short as I meter and still give excellent results when the capacity to ground at the antenna is low. A.R.H.

N79-20097# Rome Air Development Center, Griffiss AFB, N.Y.
NUMERICAL TEST OF KELVIN'S PHASE APPROXIMATION IN CALCULATING THE MAGNETIC FIELD OF AN ELEMENTAL RING OF MERIDIONAL CURRENTS ON A SPHERE
B. Prasad and E. J. Tichovolsky Apr. 1978 14 p refs
(AD-A062410; RADC-TR-78-83) Avail: NTIS HC A02/MF A01 CSCL 20/14

An integral expression is derived for the surface magnetic field produced by a ring of meridional currents on a perfectly conducting sphere. This expression is approximated via Kelvin's stationary phase principle, and numerically compared with an evaluation of the integral via Chebyshev's Quadratures. The results have implications for the prediction of LORAN navigation coordinates. Author (GRA)

N79-20098# Teledyne Systems Co., Northridge, Calif.
SAINT MARYS RIVER LORAN - C PRECISION GUIDANCE SYSTEM IMPROVEMENTS, VOLUME 1 Final Report
E. Dietrich, J. Holdsworth, and M. Sturza Sep. 1978 62 p ref
(Contract DOT-CG-72552-A)
(AD-A062160; USCG-D-57-78-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 17/7

This report presents the modifications that were implemented into the St. Marys River LORAN-C precision guidance system to improve navigation accuracy, graphics display presentation, and system performance. In addition, the degree of improvements under simulated conditions are shown. Prior to the implementation of the system improvements, the United States Coast Guard tested and evaluated the LORAN guidance system extensively on USCG vessels and a commerical iron ore carrier. During the tests several deficiencies were observed in the system's accuracy and graphics performance. The navigation accuracy objective is a maximum cross-track error on the order of 25 feet using LORAN-C data integrated with gyrocompass heading information. To achieve this objective the precision guidance system has been improved by incorporating a more accurate LORAN receiver oscillator and modifying the Kalman filter and gyrocompass software algorithms. In addition, the rate of processing navigation data has been increased by improving the overall software. Graphics display presentation was improved by modifying the software to reduce clutter on the display screen. Several performance improvements were also incorporated.Author (GRA)

N79-20011# Armament Development and Test Center, Eglin AFB, Fla.
NEW WEAPON CONCEPTS DEVELOPED FROM ADVANCED NAVIGATION GUIDANCE AND TARGETING TECHNOLOGY
H. E. Brown *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 2 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20016# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
REDUNDANT STRAPDOWN NAVIGATION, GUIDANCE, AND CONTROL OF A CONTROL CONFIGURED VEHICLE
Wolfgang J. Kubbat and George A. Napjus *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 18 p refs Prepared in cooperation with Teledyne Systems Co., Northridge, Calif. (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20018# Norwegian Defence Research Establishment, Kjeller.
APPLICATION OF PARALLEL FILTERS FOR MALFUNCTION DETECTION AND ALTERNATIVE MODE CAPABILITY
T. Smestad and O. Orpen *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 8 p refs (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N79-20099*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.
FLAP-LAG-TORSION FLUTTER ANALYSIS OF A CONSTANT LIFE ROTOR
Inderjit Chopra Jan. 1979 42 p
(Grant NsG-2317)
(NASA-CR-152244; SU-JIAA-TR-17) Avail: NTIS HC A03/MF A01 CSCL 01C

The constant lift rotor (CLR) employs a control input of pitch moment to several airfoil sections which are free to pivot on a continuous spar, allowing them to change their pitch to obtain the desired lift. A flap-lag-torsion flutter analysis of a constant lift rotor blade in hover was developed. The blade model assumes rigid body flap and lead-lag motions at the root hinge and each strip undergoes an independent torsional motion. The results are presented in terms of root locus plots of complex eigenvalues as a function of thrust. The effects of several parameters (including structural damping, center of gravity and elastic axis offset from aerodynamic center, compressibility pitch-lag and pitch-flap coupling) on the blade dynamics are examined. With a suitable combination of lag damper and pitch-flap coupling, it is possible to design a constant lift rotor blade free from flutter instability. Author

N79-20100*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRCRAFT ENERGY EFFICIENCY LAMINAR FLOW CONTROL GLOVE FLIGHT CONCEPTUAL DESIGN STUDY
Andrew S. Wright Jan. 1979 34 p refs
(NASA-TM-80054) Avail: NTIS HC A03/MF A01 CSCL 01C

A laminar flow control glove applied to the wing of a short to medium range jet transport with aft mounted engines was designed. A slotted aluminum glove concept and a woven stainless steel mesh porous glove concept suction surfaces were studied. The laminar flow control glove and a dummy glove with a modified supercritical airfoil, ducting, modified wing leading and trailing edges, modified flaps, and an LFC trim tab were applied to the wing after slot spacing suction parameters, and compression power were determined. The results show that a laminar flow control glove can be applied to the wing of a jet transport with an appropriate suction system installed. S.E.S.

N79-20101*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF A MILITARY CARGO POD AND TAIL FINS ON THE AERODYNAMIC CHARACTERISTICS OF A LARGE WIDE-BODY TRANSPORT MODEL
Lloyd S. Jernell and Delwin R. Croom Feb. 1979 21 p refs
(NASA-TM-80052) Avail: NTIS HC A02/MF A01 CSCL 01C

Wind tunnel tests were conducted on a 0.03 scale model of a large wide-body commercial aircraft to determine the effects on the static aerodynamic characteristics resulting from the attachment of a belly pod for the long-range deployment of outsize military equipment. The effectiveness of horizontal-tip fins in augmenting directional stability was investigated. At a test Reynolds number of 1.08 x 1,000,000, the addition of the pod results in an increase in total drag of approximately 20 percent. Trim drag due to the pod is very small. Although the pod produces

a significant decrease in directional stability, the addition of the tip fins restores some of the stability, particularly at the lower angles of attack. S.E.S.

N79-20102*# National Aeronautics and Space Administration, Washington, D. C.
ICING TESTING IN THE LARGE MODANE WIND-TUNNEL ON FULL-SCALE AND REDUCED SCALE MODELS
F. Charpin and G. Fasso Mar. 1979 20 p refs Transl. into ENGLISH from Aeronaut. Astronaut. (France), no. 38, 1972 p 23-31 Presented at Conf. on Protection Against Icing, London, 10 May 1972 Original language document was announced as A73-20244 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75373) Avail: NTIS HC A02/MF A01 CSCL 01C

Icing tests on full scale models of parts of aircraft (wings, tailplanes, radome) equipped with actual de-icing systems were carried out in the large Modane wind tunnel of ONERA. For studying icing on the Concorde, it was necessary to use a 1/6 scale half model. The equations governing the relevant parameter ratios to obtain reasonably good similitude water catching and ice accretion are recalled. Despite the inherent limitations of this particular kind of testing, i.e., the impossibility of duplicating both the Mach and Reynolds conditions for the main flow pattern, it is possible to obtain on a reduced scale model a reasonably good representation of icing cloud catching and of the shape of resulting ice accretion. Author

N79-20103*# Washington Univ., St. Louis, Mo. School of Engineering and Applied Science.
THE ROLE OF ROTOR IMPEDANCE IN THE VIBRATION ANALYSIS OF ROTORCRAFT, PART 4 Final Report
Kurt H. Hohenemser Jun. 1978 38 p refs Prepared for Army Aviation Res. and Develop. Command, Moffett Field, Calif.
(Contract NAS2-7613)
(NASA-CR-152261) Avail: NTIS HC A03/MF A01 CSCL 01C

A method for a strongly idealized case of vertical excitation and for rolling and pitching moment excitation of a four bladed hingeless rotor on an up-focussing flexible mount is developed. The aeroelastic rotor impedances are computed directly with a finite blade element method that includes aerodynamics. The rotor impedance matrix for three or more blades is determined from the root moment impedance for a single blade by a simple multiblade transformation rule. Force and moment amplitudes transferred from the rotor to support are found to be critically dependent on the support dynamics. S.E.S.

N79-20104*# Grumman Aerospace Corp., Bethpage, N.Y.
VALIDATION OF SCRAMJET EXHAUST SIMULATION TECHNIQUE AT MACH 6 Final Report
H. B. Hopkins, W. Konopka, and J. Leng Washington NASA Mar. 1979 101 p refs
(Contract NAS1-14152)
(NASA-CR-3003; RE-547) Avail: NTIS HC A06/MF A01 CSCL 01C

Current design philosophy for hydrogen-fueled, scramjet-powered hypersonic aircraft results in configurations with strong couplings between the engine plume and vehicle aerodynamics. The experimental verification of the scramjet exhaust simulation is described. The scramjet exhaust was reproduced for the Mach 6 flight condition by the detonation tube simulator. The exhaust flow pressure profiles, and to a large extent the heat transfer rate profiles, were then duplicated by cool gas mixtures of Argon and Freon 13B1 or Freon 12. The results of these experiments indicate that a cool gas simulation of the hot scramjet exhaust is a viable simulation technique except for phenomena which are dependent on the wall temperature relative to flow temperature. G.Y.

N79-20105# Lockheed-California Co., Burbank.
FORMULAS FOR TAKEOFF PERFORMANCE P3-A, B AND C AIRPLANES Final Report
Joseph G. Carrillo and William M. Purdy 27 Jul. 1978 32 p refs
(Contract N00014-77-C-0461)
(AD-A062290; LR-28461) Avail: NTIS HC A03/MF A01 CSCL 01/2

The increase in program steps to more than 200 and larger memory storage of handheld computers appears to make practicable their use in preflight planning of military missions by flight crews. Such application would provide greater accuracy and enhance efficient utilization of airplane capability. Contract No. N00014-77-C-0461 authorized development of formulas to calculate takeoff field length requirements and pertinent airspeeds and powerplant performance to test the feasibility of this application. This report contains formulas for the performance items authorized by the contract. It is recommended that they be programmed for use with a hand-held computer and that computer solutions be evaluated for flight planning for service missions of P-3 airplanes. Author (GRA)

N79-20106# Naval Surface Weapons Center, Dahlgren, Va.
A COMPUTER MODEL FOR DETERMINING WEAPON RELEASE PARAMETERS FOR A HELICOPTER IN NON-ACCELERATED FLIGHT Final Report
R. P. Hennis and B. W. McCormick Oct. 1978 73 p refs
(AD-A062155; NSWC/DL-TR-3823) Avail: NTIS HC A04/MF A01 CSCL 16/1

A mathematical model capable of computing flight path and orientation data for helicopters having a single main rotor and a vertical tail rotor is presented. The model calculates power level and control angles in steady (trimmed) flight for ascending, level, or descending flight paths. Provisions are included for simulating a fixed wing, auxiliary thrust, and a movable horizontal tail whose incidence angle is linked to the main rotor longitudinal cyclic control. The model is coded in Fortran Extended to run on the CDC 6700 Computer system. Output from this model is used in the generation of aiming data for the delivery of unguided ordnance. Author (GRA)

N79-20107# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
OPTIMUM CRUISE PERFORMANCE Final Technical Report, Jun. - Aug. 1977
Nguyen X. Vinh Nov. 1978 130 p refs
(AD-A062607; AFFDL-TR-78-131) Avail: NTIS HC A07/MF A01 CSCL 01/2

This report considers the cruise performance of a jet-propelled aircraft at high speed. The two problems of cruise with maximum range and with maximum endurance are analyzed. In each problem, for any given aircraft aerodynamics and engine characteristics, the equation for determining the optimum Mach number for cruise is derived. For maximum range, there exists an optimum cruise altitude. For the maximum endurance problem, the effect of the altitude on performance is negligible. It is shown that in both problems, constant Mach number cruise is a satisfactory flying technique. In the true optimum solution the optimum Mach number slowly decreases along the flight path. In this case, the singular thrust control is obtained explicitly as function of the Mach number. Author (GRA)

N79-20108# General Electric Co., Schenectady, N. Y.
ANALYSIS AND CALCULATIONS OF LIGHTNING INTERACTIONS WITH AIRCRAFT ELECTRICAL CIRCUITS Final Report, 16 May 1976 - 21 Feb. 1978
F. A. Fisher Aug. 1978 398 p
(Contract F33615-76-C-3122)
(AD-A062606; SRD-78-044; AFFDL-TR-78-106) Avail: NTIS HC A17/MF A01 CSCL 01/3

This report documents the results of a study performed to evaluate the indirect effects of lightning strikes - specifically, induced voltages - on the electrical systems of aircraft. Numerical methods for evaluating the fields produced by lightning currents flowing the skin of the aircraft are presented as a first analytical step. Additional numerical methods, for computing the voltages induced in wiring systems by the fields evaluated in the first step, are also presented, as are recommendations on the direction of further study. Author (GRA)

N79-20109# Dynamics Research Corp., Wilmington, Mass. Systems Div.
AN ANALYSIS OF FUEL CONSERVING OPERATIONAL PROCEDURES AND DESIGN MODIFICATIONS FOR BOMBER/TRANSPORT AIRCRAFT, VOLUME 2 Final Report,

7 Jun. 1978 - 7 Jul. 1978
Romesh K. Aggarwal Jul. 1978 508 p refs
(Contract F33615-76-C-3104)
(AD-A062609; R-247U; AFFDL-TR-78-96-Vol-2) Avail: NTIS HC A22/MF A01 CSCL 01/3

Various proposed improvements in the design and operational procedures for bomber/transport aircraft are evaluated. The evaluation is performed in terms of the estimated savings in fuel consumption and in Direct Operating Cost (DOC). As an aid in the evaluation of design modifications, graphs of fuel and DOC savings as a function of the design parameters are developed. These graphs are based on actual mission trajectory data rather than some typical trajectory profile. The actual mission data is presented in terms of histograms which provide statistical information concerning altitude, air speed, take-off weight, landing weight, and mission time. Separate analyses are performed on the following aircraft: the B-52G, the B-52H, the KC-135, the C-141, the C-130, and the C-5A. Author (GRA)

N79-20110# Texas Technological Coll., Lubbock. Dept. of Civil Engineering.
DYNAMICS OF COMPLEX STRUCTURES-ANALYSIS AND EXPERIMENT: DAMAGED AIRCRAFT STABILATORS Final Technical Report, 15 Jan. 1977 - 15 Jul. 1978
Jimmy H. Smith and M. Lynn Beascon Nov. 1978 88 p refs
(Grant AF-AFOSR-3231-77)
(AD-A062691; AFOSR-78-1621TR) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report presents the results of an experimental and analytical program employed to determine the effect that damage to a horizontal stabilator has on structural characteristics such as stiffness, natural frequencies and damping. A simplified method of computing the change in the fundamental frequency as damage increases is also developed. Author (GRA)

N79-20001*# Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.
FLIGHT TEST TECHNIQUES FOR LOW SPEED AIRFOIL EVALUATION
M. J. Hoffmann, G. M. Gregorek, and G. S. Weislogel *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 623-642 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01C

N79-20002*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
IN-FLIGHT THREE-DIMENSIONAL BOUNDARY LAYER AND WAKE MEASUREMENTS FROM A SWEPT SUPERCRITICAL WING
David P. Lux *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 643-655 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01A

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N79-20111*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SURVEY OF HELICOPTER CONTROL/DISPLAY INVESTIGATIONS FOR INSTRUMENT DECELERATING APPROACH
J. Victor Lebacqz Mar. 1979 133 p refs
(NASA-TM-78565; A-7751) Avail: NTIS HC A07/MF A01 CSCL 01D

Control-display requirements for helicopters conducting decelerating approaches in the terminal area under instrument meteorological conditions were surveyed. The programs are organized on the basis of the control augmentation concepts that were considered, and the results are summarized and compared. Nine control-display combinations are hypothesized as possible candidates for future ground and in-flight investigation. Specific guidelines for the guidance relationship, control characteristics, and display presentation concepts are given. S.E.S.

N79-20112*# Aerospace Systems, Inc., Burlington, Mass.
DISPLAY/CONTROL REQUIREMENTS FOR AUTOMATED VTOL AIRCRAFT Final Report
W. C. Hoffman, D. L. Kleinman, and L. R. Young Oct. 1976 161 p refs
(Contract NAS1-13653)
(NASA-CR-158905; ASI-TR-76-39) Avail: NTIS HC A04/MF A01 CSCL 01D

A systematic design methodology for pilot displays in advanced commercial VTOL aircraft was developed and refined. The analyst is provided with a step-by-step procedure for conducting conceptual display/control configurations evaluations for simultaneous monitoring and control pilot tasks. The approach consists of three phases: formulation of information requirements, configuration evaluation, and system selection. Both the monitoring and control performance models are based upon the optimal control model of the human operator. Extensions to the conventional optimal control model required in the display design methodology include explicit optimization of control/monitoring attention; simultaneous monitoring and control performance predictions; and indifference threshold effects. The methodology was applied to NASA's experimental CH-47 helicopter in support of the VALT program. The CH-47 application examined the system performance of six flight conditions. Four candidate configurations are suggested for evaluation in pilot-in-the-loop simulations and eventual flight tests. A.R.H.

N79-20113# Weapons Systems Research Lab., Adelaide (Australia).
THE SOFTWARE FOR THE CAPTIVE TRAJECTORY YAWMETER SYSTEM
I. C. Heron and G. R. Bishop Apr. 1978 93 p refs
(WSRL-0005-TR; AR-0001-176) Copyright. Avail: NTIS HC A05/MF A01

The mathematical analysis and software associated with the Captive trajectory yawmeter system (CTYS), used to simulate store separation from aircraft are described. The CTYS uses a yawmeter probe attached to a traverse rig to measure flow conditions from which store loads are derived, and thus differs from the traditional captive trajectory system in which store loads are measured directly. The CTYS is therefore applicable to small continuous flow wind tunnels. Computer listings of all programs are included. A.R.H.

N79-20017# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
PRELIMINARY FEASIBILITY ASSESSMENT OF MULTI-FUNCTION INERTIAL REFERENCE ASSEMBLY (MIRA)
John M. Perdzock and Robert C. Burns *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 16 p ref Prepared in cooperation with McDonnell Douglas Corp., St. Louis, Mo. (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20019# Marconi-Elliott Avionic Systems Ltd., Borehamwood (England). Airborne Display Div.
CONTROL AND DISPLAY CONCEPTS FOR COMBAT AIRCRAFT
R. H. Holmes *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 12 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20020# Ferranti Ltd., Edinburgh (Scotland). Inertial Systems Dept.
AN ADVANCED NAVIGATION DISPLAY AND ITS EFFECT ON SYSTEM DESIGN
W. H. McKinlay *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 4 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20025# Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse (France).
A RELIABLE AND SURVIVABLE DATA TRANSMISSION SYSTEM FOR AVIONICS PROCESSING
D. R. Powell, J. C. Laprie, P. Romand (Societe Crouzet), and G. Alcouffe (Societe Crouzet) *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 12 p (For primary document see N79-20009 11-01) Avail: NTIS HC A11/MF A01

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N79-20114*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARAMETRIC PERFORMANCE OF A TURBOJET ENGINE COMBUSTOR USING JET A AND A DIESEL FUEL
Helmuth F. Butze and Francis M. Humenik Mar. 1979 44 p refs
(NASA-TM-79089; E-9913) Avail: NTIS HC A03/MF A01 CSCL 21E

The performance of a single-can JT8D combustor was evaluated with Jet A and a high-aromatic diesel fuel over a parametric range of combustor-inlet conditions. Performance parameters investigated were combustion efficiency, emissions of CO, unburned hydrocarbons, and NOx, as well as liner temperatures and smoke. At all conditions the use of diesel fuel instead of Jet A resulted in increases in smoke numbers and liner temperatures; gaseous emissions, on the other hand, did not differ significantly between the two fuels. Author

N79-20115# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EMISSION SAMPLE PROBE INVESTIGATION OF A MIXED FLOW TF30 TURBOFAN ENGINE Final Report, Jan. 1974 - Jul. 1977
Gerald R. Slusher Nov. 1978 90 p refs
(FAA-NA-78-3; FAA-RD-78-89) Avail: NTIS HC A05/MF A01

The emissions in the exhaust plume of mixed-flow TF30 turbofan engine were investigated to optimize the shape, size, and location of fixed probes for acquiring representative emission samples. Traverse measurements of 121 points over the exhaust nozzle were accomplished with the sample points located on a 2-inch-square grid. The average emission levels, contours, and profile distributions were determined. Exhaust emissions were measured with four mixing multihole averaging probes in the core exhaust, the engine turbine discharge pressure probes, and an experimental diamond probe design. Results indicate that the 12-point diamond probe provides representative exhaust samples from mixed-flow TF30 engine. M.M.M.

N79-20116*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
JT8D AND JT9D JET ENGINE PERFORMANCE IMPROVEMENT PROGRAM. TASK 1: FEASIBILITY ANALYSIS Final Report, Feb. - Dec. 1977
W. O. Gaffin and D. E. Webb Apr. 1979 227 p refs
(Contract NAS3-20630)
(NASA-CR-159449; PWA-5518-38) Avail: NTIS HC A11/MF A01 CSCL 21E

JT8D and JT9D component performance improvement concepts which have a high probability of incorporation into production engines were indentified and ranked. An evaluation method based on airline payback period was developed for the purpose of identifying the most promising concepts. The method used available test data and analytical models along with conceptual/preliminary designs to predict the performance improvements, weight, installation characteristics, cost for new production and retrofit, maintenance cost, and qualitative characteristics of candidate concepts. These results were used to arrive at the concept payback period, which is the time required for an airline to recover the investment cost of concept implementation. G.Y.

N79-20117*# General Electric Co., Evendale, Ohio. Aircraft Engine Group.
THEORY OF LOW FREQUENCY NOISE TRANSMISSION THROUGH TURBINES Final Report
R. K. Matta and R. Mani Mar. 1979 153 p refs
(Contract NAS3-20027)
(NASA-CR-159457; R77AEG570) Avail: NTIS HC A08/MF A01 CSCL 21E

Improvements of the existing theory of low frequency noise transmission through turbines and development of a working prediction tool are described. The existing actuator-disk model and a new finite-chord model were utilized in an analytical study. The interactive effect of adjacent blade rows, higher order spinning modes, blade-passage shocks, and duct area variations were considered separately. The improved theory was validated using the data acquired in an earlier NASA program. Computer programs incorporating the improved theory were produced for transmission loss prediction purposes. The programs were exercised parametrically and charts constructed to define approximately the low frequency noise transfer through turbines. The loss through the exhaust nozzle and flow(s) was also considered. Author

N79-20118*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TESTS OF NASA CERAMIC THERMAL BARRIER COATING FOR GAS-TURBINE ENGINES
Curt H. Liebert 1979 10 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 23-27 Apr. 1979
(NASA-TM-79116; E-9846-1) Avail: NTIS HC A02/MF A01 CSCL 21E

A two-layer thermal barrier coating system with a bond coating of nickel-chromium-aluminum-yttrium and a ceramic coating of yttria-stabilized zirconia was tested for corrosion protection, thermal protection and durability. Full-scale gas-turbine engine tests demonstrated that this coating eliminated burning, melting, and warping of uncoated parts. During cyclic corrosion resistance tests made in marine diesel fuel products of combustion in a burner rig, the ceramic cracked on some specimens. Metallographic examination showed no base metal deterioration. S.E.S.

N79-20119# Naval Research Lab., Washington, D. C.
STRESS INTENSITY FACTORS IN THIRD-STAGE FAN DISK OF THE TF-30 TURBINE ENGINE Final Report
R. J. Sanford and J. W. Dally 15 May 1978 26 p refs
(AD-A062103; AD-E000260; NRL-8202) Avail: NTIS HC A03/MF A01 CSCL 21/5

A photoelastic determination of the mixed-mode stress-intensity factors in a scale model of the third-stage fan disk of the TF-30 turbine engine was performed. A series of 23 tests were conducted to obtain isochromatic fringe patterns at the tip of a simulated crack as it was incrementally extended through the lug along the observed failure path. The isochromatic fringe patterns were analyzed by employing a newly developed method which permits determination of both opening and shearing mode stress-intensity factors K sub I and K sub II in the presence of far-field stresses sigma sub ox. Although both K sub I and K sub II varied as the crack extended from its initiation point to its turning point, the effective stress intensity factor K sub eff, equal to the square root of the sum of the squares of K sub I and K sub II, remained essentially constant over most of the length of the fracture path. After the crack turns, the propagation is predominantly mode I and the value of K sub eff increases dramatically with increasing crack length. Author (GRA)

N79-20120# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
ACCELERATED MISSION TEST OF A TF41 WITH AIR-COOLED SECOND STAGE TURBINE BLADES Final Report, 10 Aug. 1977 - 26 Oct. 1977
Robert J. May, Jr. Nov. 1978 148 p refs

(AF Proj. 3066)
(AD-A062835; AFAPL-TR-78-87) Avail: NTIS HC A07/MF A01 CSCL 21/5

An accelerated mission test (AMT) of a TF41 was conducted in the Air Force Aero Propulsion Laboratory's 3 stand sea level engine test facility between 10 August 1977 and 26 October 1977. The primary objective of the test was to evaluate the structural reliability of a set of aircooled second stage high pressure turbine blades under realistic usage conditions. A two hundred sixty three hour test program was initially planned but only one hundred sixty hours were actually completed due to a variety of problems. A post-test teardown inspection revealed that six of the new aircooled blades had indications of fatigue cracks near the leading edge of the blade on the suction side. Author (GRA)

N79-20121# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
HEAT TRANSFER PROBLEMS IN ADVANCED GAS TURBINES FOR NAVAL APPLICATIONS Annual Progress Report, 1 Sep. 1977 - 30 Nov. 1978
E. R. Eckert, R. J. Goldstein, and E. M. Sparrow Nov. 1978 34 p
(Contract N00014-76-C-0246; NR Proj. 097-383)
(AD-A062866) Avail: NTIS HC A03/MF A01 CSCL 21/5

The report covers heat exchanger studies stressing measurements of local heat transfer coefficients. Direct heat transfer measurements were performed and a method was also used which was based on the heat and mass transfer analog. Local ablation rates were obtained on a model covered with napthalene and heat transfer rates were deduced from these through the analogy. Measurements of the turbulence intensity in a gas stream leaving a combustion chamber were also reported. Author (GRA)

N79-20122# Rockwell International Corp., Columbus, Ohio. Aircraft Div.
COMPUTER-AIDED DESIGN STUDY OF HYPERMIXING NOZZLES Final Report, 19 Oct. 1977 - 19 Jul. 1978
L. A. Mefferd and P. M. Bevilaqua 19 Jul. 1978 85 p refs
(Contract N00019-77-C-0527)
(AD-A062374; NR78H-91) Avail: NTIS HC A05/MF A01 CSCL 21/5

A combination of computer analysis and scale model testing was utilized to compare the entrainment rates of a variety of jet mixer nozzles. The objective of the study was to develop a nozzle which would increase the performance of thrust augmenting ejectors on V/STOL aircraft. Various multi-lobe and vortex generating nozzles were devised and studied. The spreading of the jet from each nozzle was predicted by calculating a finite-difference solution of Reynolds' equations for the three dimensional flow field. A two-equation turbulence kinetic energy model was used for closure. Limited experimental testing was then performed to verify the predicted trends. It was concluded that increasing the length of the nozzle lobes produces the greatest increase in thrust augmentation, and that an alternating slot nozzle yields the greatest augmentation for a given lobe size. Author (GRA)

N79-20123# Cranfield Inst. of Technology Bedfordshire (England). School of Mechanical Engineering.
UNSTEADY EFFECTS OF CIRCUMFERENTIAL PRESSURE DISTORTED INLET FLOWS IN COMPRESSORS Progress Report, 15 Apr. - 14 Oct. 1978
R. E. Peacock Nov. 1978 39 p
(Grant AF-AFOSR-3305-77)
(AD-A062550; AFOSR-78-1629TR; PR-3) Avail: NTIS HC A03/MF A01 CSCL 21/5

Using custom designed and developed rotor borne instrumentation rotating stall phenomena are examined in lightly loaded single-stage compressor. Two different classes of rotating stall are identified and of different rotational frequency. One propagates from the blade loading edge and the other from the blade trailing edge. Author (GRA)

N79-20124# Cranfield Inst. of Technology Bedfordshire (England). School of Mechanical Engineering.
UNSTEADY EFFECTS OF CIRCUMFERENTIAL PRESSURE DISTORTED INLET FLOWS IN COMPRESSORS Interim Report, 15 Oct. 1977 - 14 Apr. 1978
R. E. Peacock May 1978 15 p
(Grant AF-AFOSR-3305-77)
(AD-A062549; AFOSR-78-1628TR; IR-2) Avail: NTIS HC A02/MF A01 CSCL 21/5

A high response measuring and data acquisition system is described which was custom designed and built for the research facility used in this investigation. The system included the potential for measuring instantaneous dynamic pressures on rotor blades in unsteady flow and the real-time analysis of data or alternatively data storage for off-line analysis. Author (GRA)

N79-20125# Williams Research Corp., Walled Lake, Mich.
LOW COST EXPENDABLE ENGINE Final Technical Report, Apr. 1976 - Mar. 1978
C. A. Huben and B. L. Metsker Wright-Patterson AFB, Ohio AFAPL Mar. 1978 119 p
(Contract F33615-76-C-2123; AF Proj. 3066)
(AD-A062864; AFAPL-TR-78-33) Avail: NTIS HC A06/MF A01 CSCL 21/5

A low cost expendable turbojet engine in the 200 pound thrust class was fabricated and tested. The design, manufacturing, and inspection concepts of the program resulted in the achievement of a projected engine cost of $2883 each in lots of 1000 engines in terms of 1975 economics. Problems solved during the compressor rig testing and engine tune-up testing are discussed. The results of the engine demonstration testing both at sea level static conditions and under a simulated Mn 0.7 condition are presented. Author (GRA)

N79-20126# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Mechanical Engineering.
RESEARCH ON THE FLUTTER OF AXIAL TURBOMACHINE BLADING
Fernando Sisto and Richard Rossin Nov. 1978 31 p
(Contract N00014-76-C-0540; NR Proj. 094-363)
(AD-A063102; NE-RT-78004) Avail: NTIS HC A03/MF A01 CSCL 20/4

Typical aerodynamic moment and free flutter measurements are presented for thin airfoils in an annular cascade. For moment measurements, the parameters of significance were mean incidence angle, interblade phase angle and amplitude of oscillation. Since measurements take the form of a continuous record of moment versus angular position, the symbolic name moment loops are used. For the free flutter measurements, the parameters of interest were stagger angle, incidence angle, torsional amplitude, and reduced frequency. The characteristics of the experimental data are discussed and comparison is made with earlier tested thick blades. Author (GRA)

N79-20127# Advisory Group for Aerospace Research and Development, Paris (France).
GUIDE TO IN-FLIGHT THRUST MEASUREMENT OF TURBOJETS AND FAN ENGINES
Jan. 1979 202 p refs
(AGARD-AG-237; ISBN-92-835-1304-5) Copyright. Avail: NTIS HC A10/MF A01

Topics include: fundamentals of thrust measurement in flight; propulsion system thrust and drag book-keeping; thrust expressions, methodology, and options; error assessment and control; and instrumentation. For individual titles, see N79-20128 through N79-20132.

N79-20128# Advisory Group for Aerospace Research and Development, Paris (France).
FUNDAMENTALS OF THRUST MEASUREMENT IN FLIGHT
In its Guide to In-Flight Thrust Measurement of Turbojets and Fan Engines Jan. 1979 p 19-25 (For primary document see N79-20127 11-07)
Avail: NTIS HC A10/MF A01

The basic requirement for separating the airframe from the engine in aircraft propulsion performance assessment is presented. The planning and management of the overall test program is discussed, and the required procedure is summarized. S.E.S.

N79-20129# Advisory Group for Aerospace Research and Development, Paris (France).

PROPULSION SYSTEM THRUST AND DRAG BOOK-KEEPING
In its Guide to In-Flight Thrust Measurement of Turbojets and Fan Engines Jan. 1979 p 27-61 (For primary document see N79-20127 11-07)
Avail: NTIS HC A10/MF A01

A consistent and standardized structure of definitions for the various components of thrust and drag is presented. The power plant and the division of technical responsibilities for the parts of the power plant are discussed. Definition of terms used in a book-keeping system is recommended. The items which should appear in the book-keeping system were examined. Wind tunnel tests needed to define the thrust/drag components and mutual interference effects are described. The prediction of performance and flight test analysis were studied. S.E.S.

N79-20130# Advisory Group for Aerospace Research and Development, Paris (France).
THRUST EXPRESSIONS, METHODOLOGY, AND OPTIONS
In its Guide to In-flight Thrust Measurement of Turbojets and Fan Engines Jan. 1979 p 63-118 (For primary document see N79-20127 11-07)
Avail: NTIS HC A10/MF A01

Methods for determining engine standard gross and net thrust which, directly or indirectly, form the basis of virtually all procedures for evaluating thrust in flight are presented. The methods include: brochure, gas generators, swinging probe, trunnion thrust, and engine calibration conditions. S.E.S.

N79-20131# Advisory Group for Aerospace Research and Development, Paris (France).
ERROR ASSESSMENT AND CONTROL
In its Guide to In-Flight Thrust Measurement of Turbojets and Fan Engines Jan. 1979 p 119-173 (For primary document see N79-20127 11-07)
Avail: NTIS HC A10/MF A01

Mathematical models are used to describe the properties of error distributions to enable the uncertainty of various results to be calculated. Thrust in-flight experiment to identify methods of high validity, to eliminate mistakes, and to assess and control errors is presented. S.E.S.

N79-20132# Advisory Group for Aerospace Research and Development, Paris (France).
INSTRUMENTATION
In its Guide to In-Flight Thrust Measurement of Turbojets and Fan Engines Jan. 1979 p 175-198 refs (For primary document see N79-20127 11-07)
Avail: NTIS HC A10/MF A01

Systems design, design methods for reducing error, methods for reducing error in specific measurements, cost effectiveness in instrumentation, and properties of an accurate system of instrumentation are presented. S.E.S.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N79-20133*# Analytic Sciences Corp., Reading, Mass.
MODERN DIGITAL FLIGHT CONTROL SYSTEM DESIGN FOR VTOL AIRCRAFT
John R. Broussard, Paul W. Berry, and Robert F. Stengel Hampton, Va. NASA Mar. 1979 250 p refs
(Contract NAS1-14358)
(NASA-CR-159019) Avail: NTIS HC A11/MF A01 CSCL 01D

Methods for and results from the design and evaluation of a digital flight control system (DFCS) for a CH-47B helicopter are presented. The DFCS employed proportional-integral control logic to provide rapid, precise response to automatic or manual guidance commands while following conventional or spiral-descent approach paths. It contained altitude- and velocity-command modes, and it adapted to varying flight conditions through gain scheduling. Extensive use was made of linear systems analysis techniques. The DFCS was designed, using linear-optimal estimation and control theory, and the effects of gain scheduling are assessed by examination of closed-loop eigenvalues and time responses. J.A.M.

N79-20134*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
STABILITY AND CONTROL DERIVATIVE ESTIMATES OBTAINED FROM FLIGHT DATA FOR THE BEECH 99 AIRCRAFT
Russel R. Tanner and Terry D. Montgomery Apr. 1979 38 p refs
(NASA-TM-72863; H-1081) Avail: NTIS HC A03/MF A01 CSCL 01C

Lateral-directional and longitudinal stability and control derivatives were determined from flight data by using a maximum likelihood estimator for the Beech 99 airplane. Data were obtained with the aircraft in the cruise configuration and with one-third flap deflection. The estimated derivatives show good agreement with the predictions of the manufacturer. Author

N79-20135*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PITCH ATTITUDE STABILIZATION SYSTEM UTILIZING ENGINE PRESSURE RATIO FEEDBACK SIGNALS Patent Application
Wendell W. Kelley, inventor (to NASA) Filed 28 Feb. 1979 14 p
(NASA-Case-LAR-12562-1; US-Patent-Appl-SN-015995) Avail: NTIS HC A02/MF A01 CSCL 01C

The invention relates to a pitch attitude stabilization system in which engine pressure ratio (EPR) signals are used to cancel pitching moments due to changes in thrust. The invention consists essentially of aircraft engine instrumentation 15 that generates an EPR signal. In a first embodiment of the invention, the EPR signal is compared to a reference EPR signal 46 by means of a summing device 47. The resulting difference signal is multiplied by a constant K sub EPR to form a control signal which cancels pitching moments due to changes in thrust. This control signal is added to the other pitch control signals by a summing device 32. NASA

N79-20136*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A VELOCITY VECTOR CONTROL SYSTEM AUGMENTED WITH DIRECT LIFT CONTROL Patent Application
Henry F. Tisdale, Sr. (Tisdale, Henry F., Sr., Oakhurst, N. J.) and Wendell W. Kelley, inventors (to NASA) Filed 28 Feb. 1979 16 p Sponsored by NASA
(NASA-Case-LAR-12268-1; US-Patent-Appl-SN-015996) Avail: NTIS HC A02/MF A01 CSCL 01C

A pilot controlled stability control system is described that employs direct lift control (spoiler control) with elevator control to control the flight path angle of an aircraft. A computer on the aircraft generates an elevator control signal and a spoiler control signal, using a pilot-controlled pitch control signal and pitch rate, vertical velocity, roll angle, groundspeed, engine pressure ratio and vertical acceleration signals which are generated on the aircraft. The direct lift control by the aircraft spoilers improves the response of the aircraft flight path angle and provides short term flight path stabilization against environmental disturbances. NASA

N79-20137# Advisory Group for Aerospace Research and Development, Paris (France).
EXCITATION AND ANALYSIS TECHNIQUE FOR FLUTTER TESTS
G. Haidl (Messerschmitt-Boelkow-Blohm GmbH., Munich) and M. Steininger (Messerschmitt-Boelkow-Blohm GmbH., Munich) Jan. 1979 31 p refs Presented at 47th Structures and Mater. Panel Meeting, Florence, Sep. 1978
(AGARD-R-672; ISBN-92-835-1309-6) Avail: NTIS HC A03/MF A01

Excitation methods applied recently for flight flutter testing were surveyed. Examples of excitation by frequency sweep, pseudo-random, harmonic oscillation and control feedback technique are given and their effectiveness and adaption to digital

processing is discussed. Experience with generating aerodynamic forces by control-surfaces or additional vanes is presented. The digital analysis of flight flutter test data is described. Recommendations for selection of analysis parameters and how to avoid errors due to digital processing are given. For data evaluation in flight flutter tests the autopower spectrum and transfer and coherence function are used. Errors and effects of digital blockwise computation and analysis procedures like block overlapping, windowing, averaging or curve fitting are demonstrated. The filter correlation and the modal analysis technique are applied for mode separation and damping evaluation based on the above mentioned functions. Practical experiences and examples from wind tunnel, flight and laboratory tests are discussed. An on-line computer program for realtime calculation of resonance frequencies and damping factors is presented. S.E.S.

N79-20138# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AGARD FLIGHT TEST INSTRUMENTATION SERIES. VOLUME 9: AEROELASTIC FLIGHT TEST TECHNIQUES AND INSTRUMENTATION
J. W. G. vanNunen, ed. and G. Piazzoli, ed. Feb. 1979 50 p (AGARD-AG-160-Vol-9; ISBN-92-835-1311-8) Avail: NTIS HC A03/MF A01

The flight test instrumentation for determining the flutter behavior of an aircraft is presented. The mechanism of flutter is reviewed and the following items are discussed: (1) requirements which the type of excitation should obey in order to enable the determination of the flutter characteristics; (2) possible means of excitation; (3) appropriate instrumentation; and (4) data analysis procedures. S.E.S.

N79-20139# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE FLIGHT MECHANICS PANEL SYMPOSIUM ON STABILITY AND CONTROL
Charles R. Chalk (Calspan Corp., Buffalo, N. Y.) Jan. 1979 18 p ref Symp. held at Ottawa, 25-28 Sep. 1978 (AGARD-AR-134; ISBN-92-835-1308-8) Avail: NTIS HC A02/MF A01

Some of the possibilities for matching control systems and characteristics to aircraft mission requirements were examined. The technology of active control concepts and CCV to operational aircraft is reported. Questions concerning the operational needs, cost effectiveness, reliability, and maintenance of the active control concepts and CCV are discussed. S.E.S.

N79-20006*# Boeing Vertol Co., Philadelphia, Pa.
OBSERVATIONS ON THE DYNAMIC STALL CHARACTERISTICS OF ADVANCED HELICOPTER ROTOR AIRFOILS
L. Dadone *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 701-715 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 01C

N79-20010# European Office of Aerospace Research and Development, London (England).
THE IMPACT OF INTEGRATED GUIDANCE AND CONTROL TECHNOLOGY ON WEAPONS SYSTEM DESIGN
Eugene L. DeNezza *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 5 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20014# Marconi-Elliott Avionic Systems Ltd., Rochester (England). Airport Works.
DIGITAL FLIGHT CONTROL SYSTEM ARCHITECTURE AND IMPLEMENTATION
G. Belcher, P. A. Daniell, and E. M. Scott *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 6 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20015# Lear Siegler, Inc., Grand Rapids, Mich.
DEVELOPMENT OF THE INTEGRATED FLIGHT TRAJECTORY CONTROL CONCEPT
M. W. Bird, W. L. Young (AFFDL), L. Addis, and G. L. Comegys *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 15 p refs (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20022# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DESIGN CONSIDERATIONS FOR IMPLEMENTING INTEGRATED MISSION-TAILORED FLIGHT CONTROL MODES
James K. Ramage and Frank R. Swortzel *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 18 p refs (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20023# Litton Systems, Inc., Woodland Hills, Calif. Guidance and Control Systems Div.
TARGET MARKER PLACEMENT FOR DIVE-TOSS DELIVERIES WITH WINGS NON-LEVEL
J. Stanley Ausman *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 11 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20983# European Space Agency, Paris (France).
FLUTTER SUPPRESSOR FOR TRANSONIC FLIGHT
Roger Destuynder *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-3 (ESA-TT-522) Dec. 1979 p 46-64 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 117-123 Original report in FRENCH previously announced as A78-47346 (For primary document see N79-20980 11-99)
Avail: NTIS HC A06/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N79-20140*# Spectron Development Labs., Inc., Costa Mesa, Calif.
FEASIBILITY STUDY OF TRANSIT PHOTON CORRELATION ANEMOMETER FOR AMES RESEARCH CENTER UNITARY WIND TUNNEL PLAN Final Report
W. T. Mayo, Jr. and A. E. Smart 7 Feb. 1979 86 p refs Original contains color illustrations
(Contract NAS2-10072)
(NASA-CR-152238; SDL-79-6397) Avail: NTIS HC A05/MF A01 CSCL 14B

A laser transit anemometer measured a two-dimensional vector velocity, using the transit time of scattering particles between two focused and parallel laser beams. The objectives were: (1) the determination of the concentration levels and light scattering efficiencies of naturally occurring, submicron particles in the NASA/Ames unitary wind tunnel and (2) the evaluation based on these measured data of a laser transit anemometer with digital correlation processing for nonintrusive velocity measurement in this facility. The evaluation criteria were the speeds at which point velocity measurements could be realized with this technique (as determined from computer simulations) for given accuracy requirements. J.A.M.

N79-20141# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
IMPROVEMENT OF FLOW QUALITY AT THE UNIVERSITY OF WASHINGTON LOW SPEED WIND TUNNEL
Shojiro Shindo, William H. Rae, Jr., Yokio Aoki, (Boeing Commerical Airplane Co., Seattle), and Eugene G. Hill, (Boeing Commercial Airplane Co., Seattle) 17 Aug. 1978 35 p refs Presented at AIAA 10th Aerodyn. Testing Conf., San Diego,

Calif., 19-21 Apr. 1978 Backup document for AIAA Synoptic, "Improvement of Flow Quality at the University of Washington Subsonic Wind Tunnel", scheduled for publication in Journal of Energy, May-June 1979
(AIAA-Paper-78-815) Avail: NTIS HC A03/MF A01

A method for improving flow quality in an 8 x 12 foot wind tunnel was developed. The capability to measure and interpret small changes in configuration was limited by the uniformity of flow in the test media. The improvements, which resulted in a more uniform flow, reduction of power and turbulence level, and its effect on aerodynamic test data are presented. J.A.M.

N79-20142*# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
STUDIES OF SELF STREAMLINING WIND TUNNEL REAL AND IMAGINARY FLOWS Semiannual Progress Report, Jan. - Jul. 1978
S. W. D. Wolf and M. J. Goodyer 1978 76 p refs
(Grant NsG-7172)
Avail: NTIS HC A05/MF A01 CSCL 14B

Testing in the low speed flexible walled tunnel in an effort to explain the reasons for data discrepancies at high angles of attack are presented. Automated transonic test sections were developed. The flexible walled tunnel was used in a new operating mode to a generated curved flow around the airfoil, allowing the extraction of purely rotary derivatives. Some straight wall, low speed pressure data, for wall and model, which is used for checking interference correction methods were reported. Computer software which includes an old streamlining algorithm and a prediction algorithm was examined. S.E.S.

N79-20143# ARO, Inc., Arnold Air Force Station, Tenn.
COMPUTERIZED HEAT-TRANSFER AND STRESS ANALYSIS OF WIND TUNNEL METAL THROAT LINERS Final Report, 2 Jun. 1977 - 22 Jun. 1978
Dennis T. Akers AEDC Nov. 1978 89 p refs
(AD-A062318; AEDC-TR-78-54) Avail: NTIS HC A05/MF A01 CSCL 14/2

This study presents a computerized approach to analyze the structural integrity of wind tunnel coverging-diverging nozzles or liners. In order to maintain liner configurations to produce accurate test conditions, the liners must be externally cooled, usually with water. Thermal gradients are set up in the liner and an analysis must be made to ensure adequate design. One of the most difficult problems in analyzing the liner is determining the airside, forced-convection, heat-transfer coefficient. The main reason it is so difficult is due to the boundary layer that develops along the contour of the liner. Sivells, ARO, Inc., derived, programmed, and experimentally checked a method for calculating the turbulent boundary-layer properties in the supersonic section of a liner. Using the results from Sivells' program and an iterative radial heat balance, one can write a subroutine, called HEAT, to determine: (1) The thermal gradient through the thickness of the liner; (2) The temperature profile along the length of the liner; and (3) The total stresses at any point in the liner. Included in the subroutine is a method for determining the same three conditions for the subsonic section of the liner. Author (GRA)

N79-20144# Calspan Corp., Buffalo, N. Y.
RESEARCH ON ADAPTIVE WALL WIND TUNNELS Final Report, May 1976 - Nov. 1977
Robert J. Vidal and J. C. Rickson, Jr. Nov. 1978 66 p refs
(Contract F40600-76-C-0011)
(AD-A062110; CALSPAN-RK-5934-A-1; AEDC-TR-78-36)
Avail: NTIS HC A04/MF A01 CSCL 20/4

The objective of this research was to investigate the utility of the Calspan self-correcting wind tunnel for minimizing or eliminating wall interference effects in two-dimensional transonic flows when shock waves from the test model extend to the tunnel walls. This report summarizes the experimental research performed with two-dimensional airfoils in the Calspan self-correcting wind tunnel and the theoretical research accomplished in support of the experiments. The experiments were performed with airfoil models having 4% and 6% solid blockage. The initial experiments with the 6%-blockage model were devoted to determining a practical mode of operation when shock waves from the model extend to the wall. The most practical model is to use wall control to obtain the desired distribution of longitudinal velocity components for subcritical walls. The Mach number is then increased and the wall control is readjusted, sequentially, until the desired test condition is achieved. At the high Mach numbers of interest, however, the available wall control was limited locally, and tunnel system changes were required. A method is reported for analyzing self-correcting wind tunnels with porous walls. GRA

N79-20145# Transportation Research Board, Washington, D. C.
RESEARCH IN AIRPORT PAVEMENTS
1978 124 p refs Conf. held at Atlanta, 15-17 Nov. 1976; sponsored by FAA
(PB-289432/7; TRB/SR-175; ISBN-0-309-02800-0; LC-78-10924) Avail: NTIS HC A06/MF A01 CSCL 01E

At the request of the Federal Aviation Administration, the Transportation Research Board conducted a conference on research in airport pavements. Research results that can now be implemented are in the following areas: (a) The pavement aircraft compatibility study provides a basis for trade-offs between aircraft and pavement design; (b) aircraft distribution on airport pavements for design and rehabilitation purposes; (c) mix design and construction procedures for fibrous concrete to permit its use where appropriate; (d) mix design and construction procedures for porous friction courses; (e) suitable equipment and procedures for measuring pavement unevenness; and (f) statistical quality control and quality assurance procedures for use in pavement construction and rehabilitation. GRA

N79-19991*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TRANSONIC ASSESSMENT OF TWO-DIMENSIONAL WIND TUNNEL WALL INTERFERENCE USING MEASURED WALL PRESSURES
William B. Kemp, Jr. *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 473-486 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 14B

N79-19992*# Calspan Corp., Buffalo, N. Y.
RESEARCH ON SELF-CORRECTING WIND TUNNELS
R. J. Vidal and J. C. Erickson, Jr. *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 487-498 refs (For primary document see N79-19989 11-01)
(Contracts N00014-72-C-0102; N00014-77-C-0052; F40600-76-C-0011)
Avail: NTIS HC A14/MF A01 CSCL 14B

N79-19993*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYTICAL DESIGN OF A CONTOURED WIND-TUNNEL LINER FOR SUPERCRITICAL TESTING
Perry A. Newman and E. Clay Anderson *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 499-509 refs (For primary document see N79-19989 11-01)
(Contract NAS1-14517)
Avail: NTIS HC A14/MF A01 CSCL 14B

N79-19994*# Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.
EVALUATION OF INTERFERENCE IN THE OSU 6 IN. BY 22 IN. TRANSONIC AIRFOIL TUNNEL
John D. Lee *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 511-525 ref (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 14B

N79-20004*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A NEW TWO-DIMENSIONAL OSCILLATING WING APPARATUS FOR UNSTEADY AERODYNAMICS RESEARCH
Sanford S. Davis and Gerald N. Malcolm *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 671-688 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 14B

N79-20021# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).

METHODS FOR THE VALIDATION OF SYNTHESIZED IMAGES IN VISUAL FLIGHT SIMULATION
Gert Doerfel *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 10 p refs (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20026# Singer-Kearfott, Wayne, N. J.
DYNAMIC SIMULATION OF A MULTI-SENSOR COMMUNICATION AND NAVIGATION SYSTEM
Joseph N. Frisina, William J. Steele, and Jory I. Schlenger *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 13 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20027# Boeing Aerospace Co., Seattle, Wash.
RADIO FREQUENCY (RF) HOMING MISSILE GUIDANCE AND CONTROL SIMULATION TECHNIQUES, FACILITIES, AND EXPERIENCES
G. D. Swetnam and F. M. Belrose (Redstone Arsenal, Huntsville, Ala.) *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 32 p refs (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

N79-20028# British Aerospace Aircraft Group, Warton (England).
MISSION SIMULATION AS AN AID TO DISPLAY ASSESSMENT
P. Beckett and D. E. A. Houghton *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 12 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N79-20146* National Aeronautics and Space Administration, Washington, D. C.
TECHNOLOGY FOR LARGE SPACE SYSTEMS. A SPECIAL BIBLIOGRAPHY WITH INDEXES
Apr. 1979 164 p
(NASA-SP-7046) Avail: NTIS HC A08 CSCL 22A

This bibliography lists 460 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1, 1968 and December 31, 1978. Its purpose is to provide helpful information to the researcher, manager, and designer in technology development and mission design in the area of the Large Space Systems Technology (LSST) Program. Subject matter is grouped according to systems, interactive analysis and design, structural concepts, control systems, electronics, advanced materials, assembly concepts, propulsion, and flight experiments. Author

N79-20147*# Aerospace Corp., El Segundo, Calif. Advanced Orbital Systems Div.
ADVANCED SPACE POWER REQUIREMENTS AND TECHNIQUES. TASK 1: MISSION PROJECTIONS AND REQUIREMENTS. VOLUME 3: APPENDICES
Malcolm G. Wolfe 1 Mar. 1978 1136 p ref
(Contract NASw-3078)
(NASA-CR-157266; ATR-78(7667)-1-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 22A

Contents: (1) general study guidelines and assumptions; (2) launch vehicle performance and cost assumptions; (3) satellite programs 1959 to 1979; (4) initiative mission and design characteristics; (5) satellite listing; (6) spacecraft design model; (7) spacecraft cost model; (8) mission cost model; and (9) nominal and optimistic budget program cost summaries. A.R.H.

N79-20148*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 7 USER'S GUIDE
Charles R. Madrid, ed. (Management and Tech. Services Co., Beltsville, Md.) Aug. 1978 303 p refs
(Contract NAS5-23740)
(NASA-TM-79969) Avail: NTIS HC A14/MF A01 CSCL 22A

The spacecraft operation, mission, and scientific objectives of the Nimbus 7 flight are presented, and the instruments are discussed. The formats, archiving, and access to the data are described. For individual titles, see N79-20149 through N79-20157.

N79-20149*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 7 SPACECRAFT SYSTEM **c15**
In its The Nimbus 7 User's Guide Aug. 1978 p 1-18 (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 22A

The Nimbus mission objectives, the scientific objectives of the Nimbus 7 experiments are presented. The component subsystems and experiments of the spacecraft are described. Information on data products and their availability are provided. S.E.S.

N79-20150*# National Environmental Satellite Service, Washington, D. C.
THE COASTAL ZONE COLOR SCANNER (CZCS) EXPERIMENT **c35**
Warren Hovis *In* NASA. Goddard Space Flight Center The Nimbus 7 User's Guide Aug. 1978 p 19-32 refs (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 14B

The CZCS is used to map chlorophyll concentration, sediment distribution, gelbstroffe concentration, and temperature of coastal waters and the open ocean. The data processing techniques used to enhance contrasts over the ocean and to remove the effect of the backscattered atmosphere are presented. The multi-channel scanning radiometer of CZCS is described. The content of water is determined primarily by the CZCS measurement. S.E.S.

N79-20151*# National Environmental Satellite Service, Washington, D. C.
THE EARTH RADIATION BUDGET (ERB) EXPERIMENT **c46**
H. Jacobowitz, L. L. Stowe, and J. R. Hickey (Eppley Lab., Inc.) *In* NASA. Goddard Space Flight Center The Nimbus 7 User's Guide Aug. 1978 p 33-58 (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 04A

The radiation budget of the earth on both synoptic and planetary scales by simultaneous measurement of incoming solar radiation and outgoing earth reflected (shortwave) and emitted (longwave) radiation was determined. Both fixed wide angle sampling of terrestrial fluxes at the satellite altitude, and scanned narrow-angle sampling of the radiance components, dependent on angle are used to determine outgoing radiation. Measurements of radiation are obtained in 22 different optical channels. S.E.S.

N79-20152*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE LIMB INFRARED MONITOR OF THE STRATOSPHERE (LIMS) EXPERIMENT **c46**
J. M. Russell and J. C. Gille (Natl. Center for Atmospheric Res., Boulder, Colo.) *In* NASA. Goddard Space Flight Center The Nimbus 7 User's Guide Aug. 1978 p 71-104 Sponsored in part by NSF (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 04A

The Limb Infrared Monitor of the Stratosphere is used to obtain vertical profiles and maps of temperature and the concentration of ozone, water vapor, nitrogen dioxide, and nitric acid for the region of the stratosphere bounded by the upper troposphere and the lower mesosphere. S.E.S

N79-20153*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STRATOSPHERIC AEROSOL MEASUREMENT (SAM 2) EXPERIMENT **c46**
M. P. McCormick, L. E. Mauldin, III, L. R. McMasters, W. P. Chu, and T. Swissler (Systems and Appl. Sci. Corp., Hampton,

Va.) *In* NASA. Goddard Space Flight Center The Nimbus 7 User's Guide Aug. 1978 p 105-138 (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 04A

The Stratospheric Aerosol Measurement 2 (SAM 2) is used to map the concentration and optical properties of stratospheric aerosols as a function of altitude, latitude, and longitude. The vertical distribution of the stratospheric aerosols in the polar regions of both hemispheres is provided. S.E.S.

N79-20154*# Oxford Univ. (England). Dept. of Atmospheric Physics.
THE STRATOSPHERIC AND MESOSPHERIC SOUNDER (SAMS) EXPERIMENT c46
J. R. Drummond, J. T. Houghton, G. D. Peskett, C. D. Rodgers, M. J. Wale, J. Whitney, and E. J. Williamson *In* NASA. Goddard Space Flight Center The Nimbus 7 User's Guide Aug. 1978 p 139-174 ref (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 04A

Thermal emission and solar resonance fluorescence from the atmospheric limb are reported. Global measurements are made of radiation from the molecular species. The gas correlation spectroscopy technique based on the use of gas cells to select emission from chosen spectral lines or from particular parts of spectral lines is used. The source function and departure from the thermodynamic equilibrium between 80 and 130 kilometers associated with CO2 emission bands were investigated. The zonal wind velocity component along the line of sight is measured. S.E.S.

N79-20155*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SOLAR BACKSCATTER ULTRAVIOLET (SBUV) AND TOTAL OZONE MAPPING SPECTROMETER (TOMS) EXPERIMENT c92
Donald F. Heath, Arlin J. Krueger, and Hongwoo Park (Systems and Appl. Sci. Corp., Riverdale, Md.) *In its* The Nimbus 7 User's Guide Aug. 1978 p 175-212 refs (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 03B

The SBUV/TOMS is designed to measure the extraterrestrial ultraviolet solar irradiation and the solar ultraviolet radiation from the earth and its atmosphere. Methods to recover the ozone information from backscattered ultraviolet measurements are described. Mapping of the total ozone and 200 mb height fields is obtained. S.E.S.

N79-20156*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR) EXPERIMENT c35
Per Gloersen and Len Hardis (OAO Corp., Beltsville, Md.) *In its* The Nimbus 7 User's Guide Aug. 1978 p 213-246 refs (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 14B

Ocean momentum and energy transfer parameters on a nearly all weather operational basis are obtained and used. The winds, water vapor, liquid water content, temperature, and mean cloud droplet size are derived from low altitude parameters. S.E.S.

N79-20157*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE TEMPERATURE HUMIDITY INFRARED RADIOMETER (THIR) SUBSYSTEM c35
G. Thomas Cherrix *In its* The Nimbus 7 User's Guide Aug. 1978 247-262 (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 14B

The infrared radiation from the earth in two spectral bands during both day and night portions of the orbit is measured. Pictures of cloud cover, three dimensional mappings of cloud cover, temperature mappings of clouds, land, and ocean surface, cirrus cloud content, atmospheric contamination, and relative humidity are provided. S.E.S.

N79-20158*# Essex Corp., Huntsville, Ala.
DEVELOPMENT OF CONCEPTS FOR SATELLITE RETRIEVAL DEVICES Final Report
Edwin C. Pruett, Kem B. Robertson, III, and Tomas E. Loughead 9 Mar. 1979 78 p
(Contract NAS8-33073)
(NASA-CR-161178; H-79-04) Avail: NTIS HC A05/MF A01 CSCL 22A

The teleoperator being developed to augment the Space Transportation System (STS) for satellite placement, retrieval, or servicing at altitudes or orbital planes where it would be impractical to use the shuttle is primarily a general purpose propulsion stage that can be fitted with manipulator arms, automated servicers and satellite retrieval devices for particular missions. Design concepts for a general purpose retrieval device for docking with a satellite to which a grappling fixture has been attached, and for a retrieval device for docking with the Solar Maximum Mission (SMM) spacecraft were defined. The mechanical aspects of these two devices are discussed as well as the crew operations involved and problems created by the requirement for remote control. Drawings for the two retrieval device concepts are included. A.R.H.

N79-20159*# Tennessee Univ. Space Inst., Tullahoma.
AIR BREATHING ENGINE/ROCKET TRAJECTORY OPTIMIZATION Final Report, 1 Oct. 1978 - 28 Feb. 1979
Virgil K. Smith, III 28 Feb. 1979 189 p refs
(Contract NAS8-33225)
(NASA-CR-161184) Avail: NTIS HC A09/MF A01 CSCL 22A

This research has focused on improving the mathematical models of the air-breathing propulsion systems, which can be mated with the rocket engine model and incorporated in trajectory optimization codes. Improved engine simulations provided accurate representation of the complex cycles proposed for advanced launch vehicles, thereby increasing the confidence in propellant use and payload calculations. The versatile QNEP (Quick Navy Engine Program) was modified to allow treatment of advanced turboaccelerator cycles using hydrogen or hydrocarbon fuels and operating in the vehicle flow field. J.A.M.

N79-20160*# National Aeronautics and Space Administration, Washington, D. C.
THE SALYUT-6: THE HOPES OF TERRESTRIAL SCIENCE
B. Gerasimov Mar. 1979 6 p Transl. into ENGLISH from Sov. Rossiya (USSR), Issue 200, 31 Aug. 1978 p 3 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75392) Avail: NTIS HC A02/MF A01 CSCL 22A

The workday of the Salyut-6 cosmonauts is discussed. A brief summary of the experiments on board is given. A mention is made of a German cosmonaut on board and his use of the German-made MKF-6M. This camera which was used only recently received a high evaluation from the scientists involved. Author

N79-20161*# Princeton Combustion Lab., N. J.
DEFINITION OF SMOLDER EXPERIMENTS FOR SPACELAB Progress Report, 18 Apr. - 20 Dec. 1978
M. Summerfield, N. A. Messina, and L. S. Ingram Jan. 1979 81 p refs
(Contract NAS3-21354)
(NASA-CR-159528; PCRL-FR-79-001) Avail: NTIS HC A05/MF A01 CSCL 22A

The feasibility of conducting experiments in space on smoldering combustion was studied to conceptually design specific smoldering experiments to be conducted in the Shuttle/Spacelab System. Design information for identified experiment critical components is provided. The analytical and experimental basis for conducting research on smoldering phenomena in space was established. Physical descriptions of the various competing processes pertaining to smoldering combustion were identified. The need for space research was defined based on limitations of existing knowledge and limitations of ground-based reduced-gravity experimental facilities. S.E.S.

N79-20162*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GOVERNMENT/INDUSTRY WORKSHOP ON PAYLOAD LOADS TECHNOLOGY
1978 874 p refs Workshop held at Huntsville, Ala., 14-16 Nov. 1978

(NASA-CP-2075) Avail: NTIS HC A99/MF A01 CSCL 22A

A fully operational space shuttle is discussed which will offer science the opportunity to explore near earth orbit and finally interplanetary space on nearly a limitless basis. This multiplicity of payload/experiment combinations and frequency of launches places many burdens on dynamicists to predict launch and landing environments accurately and efficiently. Two major problems are apparent in the attempt to design for the diverse environments: (1) balancing the design criteria (loads, etc.) between launch and orbit operations, and (2) developing analytical techniques that are reliable, accurate, efficient, and low cost to meet the challenge of multiple launches and payloads. This paper deals with the key issues inherent in these problems, the key trades required, the basic approaches needed, and a summary of the state-of-the-art techniques. F.O.S.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N79-20163*# Lockheed Missiles and Space Co., Huntsville, Ala.

OPERATIONAL LOOPWHEEL SUSPENSION SYSTEMS FOR MARS ROVER DEMONSTRATION MODEL: LOOPWHEEL FAILURE REPORT

Erik J. M. West and Wolfgang Trautwein Jan. 1979 6 p

(Contract JPL-955050)

(NASA-CR-158361; LMSC-HREC-TR-D568859) Avail: NTIS HC A02/MF A01 CSCL 14B

The results are presented from the analysis of a failure which occurred in the fiberglass loop of one of the Loopwheel traction elements delivered to the Jet Propulsion Laboratory (JPL) for use on the JPL Mars Rover demonstration model. The loop failed in compression in the outer fibers forming a hinge which, through cycling, caused the inner fibers to break. The probable cause of this failure was the load being introduced as point loads at the center of the loop causing high compressive stresses and early buckling. To decrease the stress level and delay buckling, the tread lugs can be reshaped so that the entire lug contacts the ground when the loop is loaded. This can be accomplished through removal of lug material, starting with zero removal at the outer edge and linearly increasing to one-half of the lug thickness at the center. M.M.M.

N79-20164*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TRACKING AND DATA SYSTEMS SUPPORT FOR THE HELIOS PROJECT. VOLUME 3: DSN SUPPORT OF PROJECT HELIOS MAY 1976 - JUNE 1977

P. S. Goodwin, W. N. Jensen, and F. M. Flanagan 1 Mar. 1979 32 p ref

(Contract NAS7-100)

(NASA-CR-158440; TM33-752-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 22D

Spacecraft extended mission coverage does not generally carry a high priority, but Helios was fortunate in that a combination of separated viewperiods and unique utilization of the STDN Goldstone antenna have provided a considerable amount of additional science data return, particularly at key times such a perihelion and/or solar occultation. J.A.M.

N79-20165*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CALORIMETER PROBES FOR MEASURING HIGH THERMAL FLUX

Larry D. Russell Apr. 1979 13 p

(NASA-TM-78573; A-7772) Avail: NTIS HC A02/MF A01 CSCL 14B

Expendable, slug-type calorimeter probes were developed for measuring high heat-flux levels of 10-30 kW/sq cm in electric-arc jet facilities. The probes were constructed with thin tungsten caps mounted on Teflon bodies. The temperature of the back surface of the tungsten cap is measured, and its time rate of change gives the steady-state absorbed heat flux as the calorimeter probe heats to destruction when inserted into the arc jet. Design, construction, test, and performance data are presented. S.E.S.

N79-20166*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.

A NEW DIMENSION. WALLOPS ISLAND FLIGHT TEST RANGE: THE FIRST FIFTEEN YEARS

Joseph Adams Shortal Dec. 1978 784 p refs

(Contract NAS6-1364)

(NASA-RP-1028) Avail: NTIS HC A99/MF A01 CSCL 14B

A record of the first fifteen years (1945-1959) of research and development tests that were performed at Wallops Island is presented. It begins with the events that led to the establishment of the National Advisory Committee for Aeronautics flight test range on Wallops Island to the first year as a part of the National Aeronautics and Space Administration. F.O.S.

N79-20167*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ZERO-G WORKSTATION DESIGN

Robert T. Gundersen and Robert L. Bond Jun. 1976 175 p refs

(NASA-TM-80000; JSC-09962; JSC-IN-76-EW-1) Avail: NTIS HC A08/MF A01 CSCL 22B

Zero-g workstations were designed throughout manned spaceflight, based on different criteria and requirements for different programs. The history of design of these workstations is presented along with a thorough evaluation of selected Skylab workstations (the best zero-g experience available on the subject). The results were applied to on-going and future programs, with special emphasis on the correlation of neutral body posture in zero-g to workstation design. Where selected samples of shuttle orbiter workstations are shown as currently designed and compared to experience gained during prior programs in terms of man machine interface design, the evaluations were done in a generic sense to show the methods of applying evaluative techniques. J.A.M.

N79-20168# Mitre Corp., McLean, Va. Metrek Div.

EVALUATIVE STUDY OF THE MATERIALS RESEARCH LABORATORY PROGRAM Final Summary Report, 1973 - 1976

J. G. Ling, M. A. DeBolt, M. T. Lethi, B. B. Stokes, and J. Verhoeff Sep. 1978 275 p

(Contract NSF OAO-76-24069)

(PB-289867/4; MTR-7764) Avail: NTIS HC A12/MF A01 CSCL 14B

The differences between MRL's and other materials research groups in capability to perform research, nature and type of the research done and the productivity and merit of the research product were evaluated. The differences between MRL's and NSF supported materials research at universities without MRL's were studied. The non MRL's were divided into two groups; those universities that had Material Science Centers and those that did not. The differences between MRL's under ARPA and NSF management, between MRL's and DOE and NASA Labs and between MRL's and NSF supported materials research at MRL universities which received no core support were examined. GRA

N79-20433*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

DELTA NITROGEN TETROXIDE FUELING OPERATIONS

R. B. Grigsby, T. M. Cross, and T. D. Rucci *In its* Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide

Jun. 1978 p 183-196 (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N79-20169*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SKYLAB REUSE STUDY, REFERENCE DATA, PART 1 Final Report
Dec. 1978 251 p
(Contract NAS8-32917)
(NASA-CR-161187; MDC-G7556-Pt-1) Avail: NTIS HC A12/MF A01 CSCL 22A

The accommodations provided by the airlock module and the orbital workshop were completely examined with the thought of total reactivation as an enhancement to the STS long duration missions. Each subsystem is described and a summary of subsystem performance during the Skylab missions is presented. End-of-mission status and the status of today for each subsystem is shown together with refurbishment/resupply requirements and refurb kit descriptions to restore Skylab to full operational capability. An inspection/refurbishment and operations plan for Skylab is included. The initial Shuttle-tended operational activity would provide a safe, effective phase of Skylab rehabilitation while simultaneously benefitting the Orbiter crew through the addition of private accommodations, off-duty recreation area, and physical conditioning equipment. This period would also permit exercising selected onboard experiments. A.R.H.

N79-20170*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SKYLAB REUSE STUDY, REFERENCE DATA. PART 2: APPENDIXES Final Report
Dec. 1978 217 p
(Contract NAS8-32917)
(NASA-CR-161188; MDC-G7556-Pt-2) Avail: NTIS HC A10/MF A01 CSCL 22A

Contents: (1) evaluations of the dysbarism risk associated with a Skylab revisit by shuttle; (2) mission model/payload data sheets; (3) life sciences utilization of on-board Skylab medical facilities; (4) airlock module description; and (5) orbital workshop description. A.R.H.

N79-20171*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE PROPULSION TECHNOLOGY OVERVIEW
J. J. Pelouch, Jr. 1979 10 p refs To be presented at Conf. on Advanced Technol. for Future Space Systems, Hampton, Va., 8-11 May 1979; sponsored by AIAA
(NASA-TM-79104; E-9928) Avail: NTIS HC A02/MF A01 CSCL 21H

Chemical and electric propulsion technologies for operations beyond the shuttle's orbit with focus on future mission needs and economic effectiveness is discussed. The adequacy of the existing propulsion state-of-the-art, barriers to its utilization, benefit of technology advances, and the prognosis for advancement are the themes of the discussion. Low-thrust propulsion for large space systems is cited as a new technology with particularly high benefit. It is concluded that the shuttle's presence for at least two decades is a legitimate basis for new propulsion technology, but that this technology must be predicted on an awareness of mission requirements, economic factors, influences of other technologies, and real constraints on its utilization. Author

N79-20172# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SATELLITE IDENTIFICATION BY ANGLES-ONLY POSITION CORRELATION
William J. Taylor 5 Oct. 1978 21 p
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A062232; ETS-36; ESD-TR-78-254) Avail: NTIS HC A02/MF A01 CSCL 17/8

The problem of determining the identities of satellites in the field of view of an electro-optical sensor must be adequately dealt with if satellite surveillance is to become a routine operation. At the ETS, the problem of developing a quick, accurate correlation technique is complicated by the circumstance that both the data base and the computer resources are limited. A technique known as Vector/Element Comparison (VEC) has been developed to solve the problem within these constraints. This report contains the fundamentals of this technique. Methods of improving the approach, bringing more and better information to bear, are also presented. GRA

N79-20173# Air Force Academy, Colo. Frank J. Seiler Research Lab.
OPTIMAL TARGETING OF BALLISTIC MISSILES IN A TIERED AIMPOINT SYSTEM Final Report, Jun. 1977 - May 1978
S. J. Monaco and Dana Billings Aug. 1978 83 p refs
(AF Proj. 2304)
(AD-A062928; FJSRL-TR-78-0005) Avail: NTIS HC A05/MF A01 CSCL 17/7

A technique for the assignment of nuclear weapons (ICBMs and SLBMs) is presented. The assignment process is broken up into three stages: the selection of aimpoints (designated ground zeros), the assignment of weapons to these aimpoints, and a footprinting or mirvability check. The first stage is a combinatorial technique which starts with a target data base specifying the value, hardness, and location of each installation in a given complex. It then locates aimpoints within this complex with the objectives of minimizing collateral damage and extracting a required damage level from each installation. The second stage is formulated as an integer programming problem which accounts for the location of launch sites, the weapons and types available and their range and maximizes the value extracted as a result of the laydown. The final stage, although not complete, is addressed in this report. It has as its objective the footprinting of re-entry vehicles so that these assignments are feasible for a system of mirved weapons. Author (GRA)

N79-20149*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 7 SPACECRAFT SYSTEM
In its The Nimbus 7 User's Guide Aug. 1978 p 1-18 (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 22A

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N79-20174*# Science Applications, Inc., Huntsville, Ala.
TURBULENCE SIMULATION MECHANIZATION FOR SPACE SHUTTLE ORBITER DYNAMICS AND CONTROL STUDIES
Frank B. Tatom and Richard L. King Dec. 1977 53 p refs
(Contract NAS8-31173)
(NASA-CR-161194; SAI-78-766-HU) Avail: NTIS HC A04/MF A01 CSCL 22B

The current version of the NASA turbulent simulation model in the form of a digital computer program, TBMOD, is described. The logic of the program is discussed and all inputs and outputs are defined. An alternate method of shear simulation suitable for incorporation into the model is presented. The simulation is based on a von Karman spectrum and the assumption of isotropy. The resulting spectral density functions for the shear model are included. A.R.H.

N79-20175# ARO, Inc., Arnold Air Force Station, Tenn.
EFFECTS OF VERTICAL TAIL FLEXIBILITY ON THE AERODYNAMIC CHARACTERISTICS OF A 0.03-SCALE NASA SPACE SHUTTLE ORBITER AT MACH NUMBERS FROM 0.90 TO 1.55 Final Report

J. A. Black AEDC 29 Aug. 1978 29 p refs
(AD-A062377; AEDC-TSR-78-P29) Avail: NTIS HC A03/MF A01 CSCL 22/2

A 0.03-scale model of the NASA Space Shuttle Orbiter utilizing a flexible and a rigid vertical tail was tested in the Propulsion Wind Tunnel, Transonic (16T) at free-stream Mach numbers from 0.90 to 1.55, free-stream dynamic pressures from 300 to 700 psf, angles of attack from -2 to 12 deg and angles of sideslip from -5 to 9 deg for speedbrake deflections of 25 and 55 deg, and rudder deflections of 0 and 10 deg. The objective of the test was to determine the effects of vertical tail flexibility on the static stability and control characteristics of the Orbiter vehicle. GRA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N79-20176*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GLOBAL DISASTER SATELLITE COMMUNICATIONS SYSTEM FOR DISASTER ASSESSMENT AND RELIEF COORDINATION
B. E. Leroy 1979 12 p refs Presented at the Intern. Telecommun. Exposition, Dallas, 26 Feb. - 2 Mar. 1979
(NASA-TM-79105; E-9929) Avail: NTIS HC A02/MF A01 CSCL 17B

The global communication requirements for disaster assistance and examines operationally feasible satellite system concepts and the associated system parameters are analyzed. Some potential problems associated with the current method of providing disaster assistance and a scenario for disaster assistance relying on satellite communications are described. Historical statistics are used with the scenario to assess service requirements. Both present and planned commercially available systems are considered. The associated global disaster communication yearly service costs are estimated. S.E.S.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N79-20177*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A GENERALIZED MODAL SHOCK SPECTRA METHOD FOR SPACECRAFT LOADS ANALYSIS
M. Trubert and M. Salama Mar. 1979 80 p refs
(Contract NAS7-100)
(NASA-CR-158417; JPL-Pub-79-2) Avail: NTIS HC A05/MF A01 CSCL 22B

Unlike an earlier shock spectra approach, generalization permits an accurate elastic interaction between the spacecraft and launch vehicle to obtain accurate bounds on the spacecraft response and structural loads. In addition, the modal response from a previous launch vehicle transient analysis with or without a dummy spacecraft - is exploited to define a modal impulse as a simple idealization of the actual forcing function. The idealized modal forcing function is then used to derive explicit expressions for an estimate of the bound on the spacecraft structural response and forces. Greater accuracy is achieved with the present method over the earlier shock spectra, while saving much computational effort over the transient analysis. Author

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N79-20178*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INSTRUMENTATION CONCEPTS AND REQUIREMENTS FOR A SPACE VACUUM RESEARCH FACILITY
Harry N. Norton Mar. 1979 49 p refs
(Contract NAS7-100)
(NASA-CR-158423; JPL-Pub-78-105) Avail: NTIS HC A03/MF A01 CSCL 14B

An earth-orbiting molecular shield that offers a unique opportunity for conducting physics, chemistry, and material processing experiments under a combination of environmental conditions that are not available in terrestrial laboratories is equipped with apparatus for forming a molecular beam from the freestream. Experiments are carried out using a moderate energy, high flux density, high purity atomic oxygen beam in the very low density environment within the molecular shield. As a minimum, the following instruments are required for the molecular shield: (1) a mass spectrometer; (2) a multifunction material analysis instrumentation system; and (3) optical spectrometry equipment. The design is given of a furlable molecular shield that allows deployment and retrieval of the system (including instrumentation and experiments) to be performed without contamination. Interfaces between the molecular shield system and the associated spacecraft are given. An in-flight deployment sequence is discussed that minimizes the spacecraft-induced contamination in the vicinity of the shield. Design approaches toward a precursor molecular shield system are shown. A.R.H.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-20179* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CLOSED LOOP SOLAR ARRAY-ION THRUSTER SYSTEM WITH POWER CONTROL CIRCUITRY **Patent**
Robert P. Gruber, inventor (to NASA) Issued 6 Mar. 1979 8 p Filed 29 Mar. 1978 Supersedes N78-22149 (16 - 13, p 1673)
(NASA-Case-LEW-12780-1; US-Patent-4,143,314; US-Patent-Appl-SN-891370; US-Patent-Class-323-15; US-Patent-Class-323-20) Avail: US Patent and Trademark Office CSCL 20C

A power control circuit connected between a solar array and an ion thruster receives voltage and current signals from the solar array. The control circuit multiplies the voltage and current signals together to produce a power signal which is differentiated with respect to time. The differentiator output is detected by a zero crossing detector and, after suitable shaping, the detector output is phase compared with a clock in a phase demodulator. An integrator receives no output from the phase demodulator when the operating point is at the maximum power but is driven toward the maximum power point for non-optimum operation. A ramp generator provides minor variations in the beam current reference signal produced by the integrator in order to obtain the first derivative of power.

Official Gazette of the U.S. Patent and Trademark Office

N79-20180*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN OXIDE DISPERSION STRENGTHENED ALLOY FOR GAS TURBINE BLADES
T. K. Glasgow 1979 13 p refs Presented at the 20th Structures, Structural Dyn. and Mater. Conf., St. Louis, 4-6 Apr. 1979; sponsored by AIME and the Am. Soc. of Civil Engr.
(NASA-TM-79088; E-9912) Avail: NTIS HC A02/MF A01 CSCL 21H

The strength of the newly developed alloy MA-6000E is derived from a nickel alloy base, an elongated grain structure, naturally occurring precipitates of gamma prime, and an artificial distribution of extremely fine, stable oxide particles. Its composition is Ni-15Cr-2Mo-2Ta-4W-4.5Al-2.5Ti-0.15Zr 0.05C-0.01B-1.1Y2O3. It exhibits the strength of a conventional nickel-base alloy at 1400 F but is quite superior at 2000 F. Its shear strength is relatively low, necessitating consideration of special joining procedures. Its high cycle, low cycle, and thermal fatigue properties are excellent. The relationship between alloy microstructure and properties is discussed. Author

N79-20181# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLUME CHARACTERIZATION OF A ONE-MILLIPOUND SOLID TEFLON PULSED PLASMA THRUSTER Final Report, 23 Mar. 1977 - 1 Feb. 1978
L. C. Pless, L. K. Rudolph, and D. J. Fitzgerald Oct. 1978 102 p refs
(Contract F04611-77-X-0026)
(JPL-Pub-78-96; AFRPL-TR-78-83) Avail: NTIS HC A06/MF A01

The pulsed plasma thruster plume-wall backscatter characteristics of the MOLSINK facility was evaluated. Backscatter was dropped to zero as the angle between the axis and wall location reached 40 deg. This wall backscatter was found to be essentially symmetric about the plume axis. The total integrated backscatter from the MOLSINK wall was approximately equal to 5% of the total mass injected from the pulsed plasma thruster during the discharge pulse. S.E.S.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N79-20182# California Univ., Los Angeles. Dept. of Chemistry.
CHARACTERIZATION AND MOLECULAR STRUCTURE OF [(PPh3)RhC2B9H11] 2, A PHOSPHINORHODACARBORANE DIMER CONTAINING Rh-H-B BRIDGES
R. T. Baker, R. E. King, C. Knobler, C. A. Ocon, and M. F. Hawthorne Nov. 1978 14 p refs
(Contract N00014-76-C-0390)
(AD-A062838; TR-103) Avail: NTIS HC A02/MF A01 CSCL 07/3

The decomposition of Ph(H)(PPh3)2C2B9H11(I) yields 4Ph(PPh3)C2B9H1152 (II) as the only tractable product. The spectral characterization and x-ray molecular structure determination indicates that a terminal B-H bond in (I) has become a Ph-H-B bridge in (II), and (II) is thus a model intermediate in the oxidative addition of a terminal B-H bond to rhodium, the catalytic activity of (II) for the homogeneous hydrogenation of olefins and is comparable to that of (I) per rhodium center.
Author

24 COMPOSITE MATERIALS

Includes laminates.

N79-20183 Brown Univ., Providence, R. I.
EFFECTIVE CONTROL OF THE MICROSTRUCTURE OF REACTION BONDED SILICON NITRIDE (Si3N4) AS RELATED TO IMPROVED MECHANICAL PROPERTIES Ph.D. Thesis
Stephen Crosby Danforth 1978 289 p
Avail: Univ. Microfilms Order No. 7906536

The role that the microstructure of reaction bonded Si3N4 plays in determining its mechanical properties is investigated. The processing parameters involved are related to the observed variations in microstructure as determined by standard metallographic techniques plus quantitative X-ray analysis. The mechanical properties were measured as the room temperature modulus of rupture (MOR) in three and four point bending, and the fracture toughness was determined by four point bending single edge notched beams. The results indicate that thorough knowledge of: (1) the reaction mechanisms, (2) the role the various processing parameters play in altering the microstructure, and (3) how the microstructural features affect the mechanical properties, allows sufficient control over the microstructure as to yield substantial increases in the room temperature MOR with no reductions in fracture toughness. Dissert. Abstr.

N79-20184# Mississippi State Univ., Mississippi State. Energy Research Center.
TESTING AND EVALUATION OF MHD MATERIALS AND SUBSTRUCTURES Quarterly Technical Progress Report, Oct. - Dec. 1977
D. L. Murphree, C. J. Bell, R. W. Cain, T. B. Malloy, J. B. Nail, R. E. Powe, W. S. Shepard, and A. G. Wehr Jan. 1978 120 p refs
(Contract EX-76-C-01-2246)
(FE-2246-6) Avail: NTIS HC A06/MF A01

The test stand was successfully operated with air heating under total computer control and is now undergoing a program of shakedown testing. After this preliminary testing was completed the test stand will be utilized to simulate the gas-slag-seed stream and gas-side temperature conditions that will be present in the baseline plant's radiant boiler. Several thermal models were developed in order to predict the thermal performance of the test stand and the boiler test sections. A preliminary design was completed of a radiant boiler simulation system which included a radiant boiler test section and the necessary auxiliary components to produce steam at the proper temperature and pressure for proper simulation of the water-side thermal conditions and boiler tube metal temperatures. J.A.M.

N79-20185# Mississippi State Univ., Mississippi State. Energy Research Center.
TESTING AND EVALUATION OF MHD MATERIALS AND SUBSTRUCTURES Quarterly Technical Progress Report, Jan. - Mar. 1978
D. L. Murphree, C. J. Bell, R. W. Cain, T. B. Malloy, J. B. Nail, R. E. Powe, W. S. Shepard, and A. G. Wehr Apr. 1978 51 p refs
(Contract EX-76-C-01-2246)
(FE-2246-7) Avail: NTIS HC A04/MF A01

The model predicting the thermal performance of the annual boiler was refined in order to include the gravity force component. Work is also underway to complete the final design of the radiant boiler system which will include a radiant boiler test section and the necessary auxiliary components to produce steam at the proper temperature and pressure for proper simulation of the water-side thermal conditions and boiler tube metal temperatures. A gas sampling and analysis system was designed and is being constructed to analyze the gas stream at various locations along the length of the test stand. J.A.M.

N79-20186*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANISMS OF BORON FIBER STRENGTHENING BY THERMAL TREATMENT
J. A. DiCarlo 1979 27 p refs Presented at 3d Ann. Conf. on Composites and Advanced Mater., Merritt Island, Fla., 21-24 Jan. 1979; Sponsored in part by the Am. Ceram. Soc.
(NASA-TM-79077; E-9894) Avail: NTIS HC A03/MF A01 CSCL 11D

The fracture strain for boron on tungsten fibers was studied for improvement by heat treatment under vacuum or argon environments. The mechanical basis for this improvement is thermally-induced axial contraction of the entire fiber, whereby strength-controlling core flaws are compressed and fiber fracture strain increased by the value of the contraction strain. By highly

sensitive measurements of fiber density and volume, the physical mechanism responsible for contraction under both environments was identified as boron atom diffusion out of the fiber sheath. The fiber contracts because the average volume of the resulting microvoid was determined to be only 0.26 plus or minus 0.09 the average atomic volume of the removed atom. The basic and practical implications of these results are discussed with particular emphasis on the theory, use, and limitations of heat-induced contraction as a simple cost-effective secondary processing method. Author

N79-20187*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TUNGSTEN FIBER REINFORCED FeCrAlY: A FIRST GENERATION COMPOSITE TURBINE BLADE MATERIAL
D. W. Petrasek, E. A. Winsa, L. J. Westfall, and R. A. Signorelli 1979 27 p refs Presented at the 108th Ann. meeting of the Am. Inst. of Mining, Met. and Petroleum Engr., New Orleans, 18-22 Feb. 1979
(NASA-TM-79094; E-9918) Avail: NTIS HC A03/MF A01 CSCL 11D

Tungsten-fiber/FeCrAlY (W/FeCrAlY) was identified as a promising aircraft engine, first generation, turbine blade composite material. Based on available data, W/FeCrAlY should have the stress-rupture, creep, tensile, fatigue, and impact strengths required for turbine blades operating from 1250 to 1370 K. It should also have adequate oxidation, hot corrosion, and thermal cycling damage resistance as well as high thermal conductivity. Concepts for potentially low cost blade fabrication were developed. These concepts were used to design a first stage JT9D convection cooled turbine blade having a calculated 50 K use-temperature advantage over the directionally solidified superalloy blade. L.S.

N79-20188*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FABRICATION AND TESTING OF NONGRAPHITIC SUPERHYBRID COMPOSITES
R. F. Lark, J. H. Sinclair, and C. C. Chamis 1979 17 p refs To be presented at the 24th Natl. SAMPE Symp., San Francisco, 8-10 May 1979
(NASA-TM-79102; E-9926) HC A02/MF A01 CSCL 11D

The fabrication feasibility and the mechanical properties of adhesively-bonded boron/aluminum, titanium, nongraphitic fiber/epoxy-resin superhybrid composite laminates were studied for potential aerospace applications. The major guiding force was the elimination of a potential graphite fiber release problem in the event of a fire. Results show that nongraphitic fibers, such as S-glass and Kevlar 49, can be substituted for the graphite fibers used in superhybrid composites. However, the nongraphic superhydrids have lower stiffness properties than the graphitic superhybrids. In-plane and flexural moduli of the laminates studied can be predicted using linear laminate theory, while nonlinear laminate theory is required for strength predictions. L.P.

N79-20189*# Douglas Aircraft Co., Inc., Long Beach, Calif.
A STUDY ON THE UTILIZATION OF ADVANCED COMPOSITES IN COMMERCIAL AIRCRAFT WING STRUCTURE: EXECUTIVE SUMMARY
D. J. Watts Jul. 1978 58 p refs
(Contract NAS1-15004)
(NASA-CR-158902-1) Avail: NTIS HC A04/MF A01 CSCL 11D

The overall wing study objectives are to study and plan the effort by commercial transport aircraft manufacturers to accomplish the transition from current conventional materials and practices to extensive use of advanced composites in wings of aircraft that will enter service in the 1985-1990 time period. Specific wing study objectives are to define the technology and data needed to support an aircraft manufacturer's commitment to utilize composites primary wing structure in future production aircraft and to develop plans for a composite wing technology program which will provide the needed technology and data. G.Y.

N79-20190*# Douglas Aircraft Co., Inc., Long Beach, Calif.
A STUDY ON THE UTILIZATION OF ADVANCED COMPOSITES IN COMMERCIAL AIRCRAFT WING STRUCTURE Final Report
D. J. Watts Jul. 1978 249 p refs
(Contract NAS1-15004)
(NASA-CR-158902-2) Avail: NTIS HC A11/MF A01 CSCL 11D

A study was conducted to define the technology and data needed to support the introduction of advanced composite materials in the wing structure of future production aircraft. The study accomplished the following: (1) definition of acceptance factors, (2) identification of technology issues, (3) evaluation of six candidate wing structures, (4) evaluation of five program options, (5) definition of a composite wing technology development plan, (6) identification of full-scale tests, (7) estimation of program costs for the total development plan, (8) forecast of future utilization of composites in commercial transport aircraft and (9) identification of critical technologies for timely program planning. L.S.

N79-20191*# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
STATISTICAL CHARACTERIZATION OF THE FATIGUE BEHAVIOR OF COMPOSITE LAMINA Final Technical Report, 1 May 1977 - 31 Jan. 1979
Jann N. Yang and Douglas L. Jones 1979 14 p
(Grant NsG-1415)
(NASA-CR-158310) Avail: NTIS HC A02/MF A01 CSCL 11D

A theoretical model was developed to predict statistically the effects of constant and variable amplitude fatigue loadings on the residual strength and fatigue life of composite lamina. The parameters in the model were established from the results of a series of static tensile tests and a fatigue scan and a number of verification tests were performed. Abstracts for two other papers on the effect of load sequence on the statistical fatigue of composites are also presented. G.Y.

N79-20192*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPOSITES FOR ADVANCED SPACE TRANSPORTATION SYSTEMS (CASTS) Technical Report, 1 Jul. 1975 - 1 Apr. 1978
John G. Davis, Jr., comp. Mar. 1979 268 p refs
(NASA-TM-80038) Avail: NTIS HC A12/MF A01 CSCL 11D

A summary is given of the in-house and contract work accomplished under the CASTS Project. In July 1975 the CASTS Project was initiated to develop graphite fiber/polyimide matrix (GR/PI) composite structures with 589K (600 F) operational capability for application to aerospace vehicles. Major tasks include: (1) screening composites and adhesives, (2) developing fabrication procedures and specifications, (3) developing design allowables test methods and data, and (4) design and test of structural elements and construction of an aft body flap for the Space Shuttle Orbiter Vehicle which will be ground tested. Portions of the information are from ongoing research and must be considered preliminary. The CASTS Project is scheduled to be completed in September 1983. L.S.

N79-20193# Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
THE BEHAVIOR OF RECTANGULAR COMPOSITE MATERIAL PLATES UNDER LATERAL AND HYGROTHERMAL LOADS Interim Report
James G. Sloan and Jack R. Vinson Jul. 1978 129 p refs (Grant AF-AFOSR-2739-74; AF Proj. 2307)
(AD-A062262; MAE-TR-216; AFOSR-78-1477TR) Avail: NTIS HC A07/MF A01 CSCL 11/4

An analysis of generally laminated rectangular composite plates subject to lateral pressure and hygrothermal loads is presented. Included are the effects of transverse shear and transverse normal deformations--the latter effect being included to determine the importance of through the thickness hygroscopic expansions of the polymeric matrix. Solutions are obtained using the theorem of minimum potential energy for both clamped and simply-supported boundary conditions. In addition, various in-plane boundary conditions are studied to demonstrate the behavior of unsymmetric laminates subjected to a hygrothermal environment. Numerical results of plate deflections and rotations for various width to thickness and length to width aspect ratios show that, while transverse shear deformations are important,

transverse normal deformations have no appreciable influence on the solution. Results presented display the magnitude and distribution of lamina stresses under lateral pressure and hygrothermal loads for different in-plane restraint conditions and laminate lay-up patterns. GRA

N79-20194# Army Materials and Mechanics Research Center, Watertown, Mass.
IN-PLANE SHEAR TEST FOR COMPOSITE MATERIALS Final Report
John M. Slepetz, Theodore F. Zagaeski, and Robert F. Novello Jul. 1978 30 p refs
(AD-A062830; AMMRC-TR-78-30) Avail: NTIS HC A03/MF A01 CSCL 11/4

A new method for characterizing the in-plane shear properties of composite materials is discussed. The method employs an asymmetrical four-point bending (AFPB) load arrangement which subjects the test specimen to pure shear at its centerline: the shear stress distribution at this location is uniform or otherwise depending upon the specimen geometry. Demonstration tests were conducted on specimens of aluminum and two types of fiber-reinforced composites of various specimen geometries including rectangular, vee-notched rectangular, and fillet-notched rectangular. In addition, a finite element analysis of these specimen configurations was undertaken to determine the depthwise stress distribution in each case. Strain measurements on test specimens showed a parabolic distribution in rectangular specimens and a uniform distribution in vee-notched specimens. The finite element analysis, however, showed a stress concentration at the notch root in the latter case, and specimens loaded to destruction tended to fail at the notch. It was concluded that with appropriate modification in the test fixture and specimen geometry the AFPB method developed will be an effective test procedure for measurement of in-plane shear properties. Author (GRA)

N79-20195# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
EFFECTS OF MOISTURE AND TEMPERATURE ON THE ELASTIC MODULI OF COMPOSITE MATERIALS Annual Report, Mar. 1977 - Mar. 1978
George S. Springer and Chi-Hung Shen Jun. 1978 45 p refs
(Contract F33615-75-C-5165; AF Proj. 7340)
(AD-A062554; AFML-TR-78-86) Avail: NTIS HC A03/MF A01 CSCL 11/4

The buckling modulus of Thornel 300/Fiberite 1034 graphite epoxy composites was measured at temperatures ranging from 195 K to 422 K and the moisture content from 0% (dry) to 1.5% (fully saturated). The measurements were made using o degree, 90 degree and pi/4 laminates. A survey was also made of the existing data showing the effects of temperature and moisture content on the tensile modulus and the compressive modulus of different composite materials. Author (GRA)

N79-20196# Duke Univ., Durham, N. C. Dept. of Civil Engineering.
FATIGUE RESISTANCE CRITERIA FOR LAMINATED COMPOSITE STRUCTURES Final Report, 1 Apr. 1975 - 15 Jun. 1978
George J. Dvorak Oct. 1978 13 p refs
(Grants DAHC04-75-G-0131; DAHC04-77-G-0113)
(AD-A062566; SOLID MECHANICS SER-13; ARO-12825.1-E) Avail: NTIS HC A02/MF A01 CSCL 11/4

This work investigated criteria for prevention of fatigue damage in metal matrix composite laminates. The approach was based on an earlier observation that, in as-fabricated unidirectional composites with elastic-brittle fibers and soft elastic-plastic matrices, fatigue failure can be prevented if the composite shakes down during cyclic loading. First, a plasticity theory was developed for axisymmetric deformation of unidirectional composites under mechanical and thermal loads. A modified self-consistent scheme was used to evaluate the elastic-plastic response of the composite. The results were applied to heat-treatment problems and to evaluation of residual microstresses in heat-treated materials. Next, a plasticity theory was developed for fibrous laminates. To construct a phenomenological constitutive relation suitable for use in numerical solutions of geometrically complex problems in laminated structures. The author concludes that fiber reinforcement strengthens the metal matrix considerably against ultimate failure, but it does not expand significantly the elastic deformation range of the matrix in the overall stress space. The advantage derived from fiber reinforcement of metal matrices can be used only in the elastic-plastic deformation range of the composite. This opens the possibility of repeated cyclic plastic straining of the matrix in dynamic loading situations, and the prospect of low-cycle fatigue failure if the loading range is not limited by the requirement that the matrix must shake down and thus resume an elastic deformation mode. GRA

N79-20197# Virginia Polytechnic Inst. and State Univ., Blacksburg.
DEFECT-PROPERTY RELATIONSHIPS IN COMPOSITE MATERIALS, PART 3 Final Technical Report, 3 Feb. 1977 - 3 Feb. 1978
K. L. Reifsnider, E. G. Henneke, and W. W. Stinchcomb Jun. 1978 138 p refs
(Contract F33615-77-C-5044; AF Proj. 2419)
(AD-A062611; AFML-TR-78-81-Pt-3) Avail: NTIS HC A07/MF A01 CSCL 11/4

This report describes the results of an investigation of the nature of damage in two graphite-epoxy laminates under various loading histories, with special attention to the changes in mechanical properties caused by specific damage mechanisms. The results include several new findings, the development of unique investigative methods and some substantial deviations from common model predictions. The discovery of a (characteristic damage state) is reported. Author (GRA)

N79-20198# United Technologies Research Center, East Hartford, Conn.
FABRICATION AND EVALUATION OF LOW COST ALUMINA FIBER REINFORCED METAL MATRICES Interim Technical Report, 1 Mar. 1977 - 1 Aug. 1978
K. M. Prewo Nov. 1978 51 p refs
(Contract N00014-76-C-0035)
(AD-A062756; UTRC/R78-912245-5) Avail: NTIS HC A04/MF A01 CSCL 11/4

Two new fibers have been introduced into the program. Both fibers are SiC with one in a large diameter(140u) monofilament form and the other a multifilament yarn. This second fiber has only recently been developed and is produced from an organometallic precursor. The new SiC yarn was characterized as to its surface chemistry, mechanical properties, fracture morphology, and compared with the characteristics of the large diameter monofilament. Powder metallurgical and casting techniques were explored for composite fabrication and it was found that the PM approach offered the greatest success. Lost cost, high rate processing techniques were also successfully used to produce high strength composities using both high and low bonding pressures. In the later case the matrix was densified while partially molten. Composite axial strength, transverse strength, and impact energy were measured. The SiC monofilament reinforced composites offered the highest levels of strength and impact resistance; however, the strength of the fiber-matrix bond severely limited composite transverse strength. Author (GRA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N79-20199*# Battelle Columbus Labs., Ohio.
EVALUATION OF SELECTED CHEMICAL PROCESSES FOR PRODUCTION OF LOW-COST SILICON, PHASE 3 Quarterly Progress Report, 1 Oct. - 31 Dec. 1978
J. M. Blocher and M. F. Browning 15 Feb. 1979 29 p refs
Prepared for JPL
(Contracts JPL-954339; NAS7-100)
(NASA-CR-158378; DOE/JPL-954339-79/13; QPR-13) Avail:

NTIS HC A03/MF A01 CSCL 07D

Refinements of the design of the 50 MT/year Experimental Process System Development Unit were made and competitive bids were received from mechanical, electrical, and structural contractors. Bids on most of the equipment were received and cataloged. Emergency procedures were defined to counter a variety of contingencies disclosed in operations and safety reviews. Experimental work with an electrolytic cell for zinc chloride disclosed no significant increase in power efficiency by steps taken to increase electrolyte circulation. On the basis of materials compatibility and permeability tests, 310 stainless steel was chosen for the shell of the fluidized-bed reactor and SiC-coated graphite for the liner. L.S.

N79-20200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY EVALUATION OF THE ROLE OF K2S IN MHD HOT STREAM SEED RECOVERY Final Report
James Edward Bennett (Arkansas State Univ.) and Fred J. Kohl Mar. 1979 24 p refs
(Contract EF-77-A-01-2674)
(NASA-TM-79114; DOE/NASA/2674-79/1; E-9948) Avail: NTIS HC A02/MF A01 CSCL 07D

Results are presented for recent analytical and experimental studies of the role of K2S in MHD hot stream seed recovery. The existing thermodynamic data base was found to contain large uncertainties and to be nonexistent for vapor phase K2S. Knudsen cell mass spectrometric experiments were undertaken to determine the vapor species in equilibrium with K2S(c). K atoms and S2 molecules ere found to be the major vapor phase species in vacuum, accounting for greater than 99 percent of the vapor phase. Combustion gas deposition studies using No. 2 Diesel fuel were also undertaken and revealed that condensed phase K2SO3 may potentially be an important compound in the MHD stream at near-stoichiometric combustion. Author

N79-20201*# San Francisco Univ., Calif. Fire Safety Center.
LABORATORY TEST METHODS FOR EVALUATING THE FIRE RESPONSE OF AEROSPACE MATERIALS Final Technical Report, 1 Jul. 1974 - 31 Jan. 1979
Carlos J. Hilado 9 Apr. 1979 41 p refs
(Grant NsG-2039)
(NASA-CR-158441) Avail: NTIS HC A03/MF A01 CSCL 21B

The test methods which were developed or evaluated were intended to serve as means of comparing materials on the basis of specific responses under specific sets of test conditions, using apparatus, facilities, and personnel that would be within the capabilities of perhaps the majority of laboratories. Priority was given to test methods which showed promise of addressing the pre-ignition state of a potential fire. These test methods were intended to indicate which materials may present more hazard than others under specific test conditions. These test methods are discussed and arranged according to the stage of a fire to which they are most relevant. Some observations of material performance which resulted from this work are also discussed. G.Y.

N79-20202# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
ANALYSIS OF OXYGEN ENRICHED AIR SAMPLES BY GAS CHROMATOGRAPHY
Lourdes C. Fuller 10 Oct. 1978 14 p refs
(AD-A062664; NADC-78215-60) Avail: NTIS HC A02/MF A01 CSCL 06/11

The gas chromatograph was used when a method was required to determine the percentages of oxygen and argon in enriched air samples taken from experimental equipment designed to produce pure oxygen aboard an aircraft in flight. Author (GRA)

N79-20203# National Bureau of Standards, Washington, D. C. Surface Science Div.
CATALYTIC DECOMPOSITION OF FORMALDEHYDE ON SINGLE RHODIUM ATOMS Interim Report
J. T. Yates, Jr. 1 Nov. 1978 26 p refs
(Contract N00014-78-F-0008)
(AD-A062293; TR-9) Avail: NTIS HC A03/MF A01 CSCL 07/4

The interaction of H2CO with alumina-supported Rh has been studied by transmission infrared spectroscopy. It has been shown that isolated Rh atoms catalyze the decomposition of H2CO to produce carbonyl hydride species H(x)Rh-CO (x = 1,2). Species of the type Rh(HCO) and Rh(HCOH) are not observed to form in detectable amounts. Hydride bonding to rhodium carbonyl species is associated with electron donation to Rh causing a decrease in nu sub CO due to electron donation into 2 pi*-CO orbitals. Hydride displacement by CO may occur on exposure to CO(g). The conversion of the species H-Rh(CO)2 to H-Rh(CO) has been followed spectroscopically during desorption. Author (GRA)

N79-20204# California Univ., Santa Barbara. Quantum Inst.
HOW CARBON MONOXIDE BONDS TO ALUMINA-SUPPORTED RHODIUM PARTICLES: TUNNELING SPECTROSCOPY MEASUREMENT WITH ISOTOPES
R. M. Kroeker, W. C. Kaska, and P. K. Hansma Nov. 1978 25 p refs
(Contract N00014-78-C-0011)
(AD-A062951; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/3

Carbon monoxide chemisorbs in at least three different ways on alumina-supported rhodium particles: There are two different linear-bonded species and at least one bridge-bonded species. These conclusions from tunneling measurement on a model catalyst surface are based on isotope shifts with C(13)O and C(18)O. They are in agreement with the conclusions from infrared measurements on dispersed metal catalysts. Author (GRA)

N79-20205# Texas Univ. at Austin. Dept. of Chemistry.
A PHOTOELECTRON SPECTROSCOPIC-MOLECULAR ORBITAL STUDY OF SF4 AND RELATED FLUOROSULFURANES
A. H. Cowley, M. Lattman, and M. L. Walker 12 Dec. 1978 43 p refs Submitted for publication
(Contract N00014-76-C-0577; NR Proj. 053-612)
(AD-A062721; TR-78-02) Avail: NTIS HC A03/MF A01 CSCL 07/4

He(I) photoelectron spectra (UPS) are reported for SF, CF3SF3, (CF3)2SF2, Me2NSF3, (Me2N)2SF2, F3SCF2SF3, and (CF3)2S. The UPS of SF4 was interpreted on the basis of SCF-X sub alpha scattered-wave (X sub alpha SW) calculations in which the ionization energies (IE's) of all the valence molecular orbitals (MO's) were computed by the transition-state method. MNDO MO calculations have also been performed on SF4. The observation that the F(2p) pi-type orbitals are 2eV more stable in the equatorial than in the axial sites is consistant with a previous X-ray photoelectron spectroscopic study of SF4. the UPS of the other fluorosulfuranes were interpreted using qualitative arguments and on the basis of empirical trends in the IE's. For all the fluorosulfuranes studied here a correlation was noted between the IE of the sulfur 'lone-pair' MO and the sum of the group electronegativities of the equatorial substituents. Author (GRA)

N79-20206# Texas Univ. at Austin. Dept. of Chemistry.
THE ADSORPTION AND DECOMPOSITION OF METHANOL ON ALUMINUM Technical Report, 1 Jan. - 1 Dec. 1978
J. W. Rogers, Jr. and J. M. White 15 Dec. 1978 18 p refs Submitted for publication
(Contract N00014-75-C-0922; NR Proj. 056-578)
(AD-A062735; TR-9) Avail: NTIS HC A02/MF A01 CSCL 07/4

The adsorption and thermal decomposition of Ch3OH on clean polycrystalline A1 studied using UPS, XPS, and thermal desorption techniques in the temperature range 110-773 K. Molecular adsorption of CH3OH occurs at 110 K; heating leads to a surface intermediate at approx. 150 K which persists until 525 K. Beginning at 525 K CH4, CO, CO2, and H2 are evolved and by 773 K the surface is oxidized. The nature of the surface intermediate is discussed. Author (GRA)

N79-20207# Illinois Univ. at Urbana-Champaign, Urbana. Water Resources Center.

ION EXCHANGE MEMBRANE METHODS FOR CONTINUOUS REMOVAL OF IONS FROM WATER AND TRACE CHEMICAL ANALYSIS Final Report
James A. Cox Oct. 1978 75 p refs
(Contract DI-14-31-0001-8015)
(PB-288918/6; UILU-WRC-78-0138; W79-01327; OWRT-A-087-Ill(6)) Avail: NTIS HC A04/MF A01 CSCL 07D

A trace analysis of wastewater and natural water samples is discussed. Separation of the samples from concentrated receiver electrolytes by ion exchange membranes was performed which results in Donnan dialysis. The methods were superior to most other ion extraction techniques. Donnan dialysis was also used as the basis for the design of voltammetric ion selective electrodes. A system for continuous removal of selected ions which used Donnan dialysis followed by electrochemical deactivation was tested. Donnan dialysis was slower than electrodialysis under comparable conditions. A successful means of continuously reducing nitrate to ammonia was developed but removal of phosphate failed because of surface passivation. GRA

N79-20208# SRI International Corp., Menlo Park, Calif.
TEN NIOSH ANALYTICAL METHODS SET-6
Oct. 1978 247 p refs
(Contract DHEW-210-76-0123)
(PB-288629/9; NIOSH-SCP-FU-6) Avail: NTIS HC A11/MF A01 CSCL 07D

Industrial hygiene sampling and analytical methods were developed and validated under a follow-up research effort to develop measurement methods which failed to validate under the joint NIOSH/OSHA Standards Completion Program. Monitoring methods for the following substances are included: Methyl acetylene, Dinitro-o-cresol, 1-chloro-1-nitropropane, Sulfur hexafluoride, 2-4-D, Methyl formate, Strychnine, 2-4-5-T, Ammonia, and 2-Ethoxyethanol. GRA

N79-20982# European Space Agency, Paris (France).
THEORETICAL PREDICTIONS OF A HIGH VELOCITY PREMIXED, TURBULENT FLAME
Roland Borghi, Pierre Moreau, and Claude Bonniot *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-3 (ESA-TT-522) Dec. 1979 p 16-45 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 105-116 Original report in FRENCH previously announced as A78-47345 (For primary document see N79-20980 11-99)
Avail: NTIS HC A06/MF A01

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N79-20209 Brown Univ., Providence, R. I.
THE EFFECT OF LOADING RATE AND TEMPERATURE ON THE INITIATION OF FRACTURE IN A MILD, RATE-SENSITIVE STEEL Ph.D. Thesis
Laurence Stuart Costin 1978 91 p
Avail: Univ. Microfilms Order No. 7906534

Dynamic and static fracture toughness tests were conducted on 1018 cold rolled steel at selected temperatures over the range -250 F (-157 C) to 225 F (107C). The results of the dynamic fracture tests are compared to those from static tests performed on a similarly shaped specimen and the differences between the results of these tests are discussed. In addition, static and dynamic plasticity tests were performed on the 1018 steel at each temperature using the classical torsional Kolsky bar technique. The results are used in conjunction with analytical and finite element elastic-plastic stress analyses of the crack tip region to assess the effect of local plastic deformation on the fracture process. The fracture and plasticity results are presented with the focus on the microscopic mechanisms of fracture. Dissert. Abstr.

N79-20210 Cincinnati Univ., Ohio.
PRECIPITATION REACTIONS IN AUSTENITIC STAINLESS STEELS Ph.D. Thesis
Yung-Shih Chen 1978 128 p
Avail: Univ. Microfilms Order No. 7904721

Specimens of commercial austenitic stainless steels (AISI type 347, 321, 316, 316L, 304 and 304L) and Ti-modified AISI type 316 SS were held in the temperature range of 750 C - 1350 C for 15 to 25 hours to ensure that equilibrium conditions were reached. A water quench followed to prevent further precipitation reactions during the cooling process. The precipitates were extracted from bulk specimens by anodic dissolution and identified by X-ray diffraction analysis. The morphologies of the large precipitated particles were studied by SEM while the small ones were studied by TEM. Edax analysis (energy dispersive analysis for X-rays) were used to check the particle compositions and to supplement the X-ray diffraction analysis of the precipitates. The presence of precipitates in solution treated and annealed specimens is analyzed. Dissert. Abstr.

N79-20211 Nebraska Univ. - Lincoln.
GAS PHASE HYDROGEN TRANSPORT IN IRON BASED ALLOYS Ph.D. Thesis
Vijay Laxman Gadgeel 1978 109 p
Avail: Univ. Microfilms Order No. 7906224

Hollow cylindrical specimens were machined from commercial heats of Armco ingot iron, SAE 1010, 1020, 1035, 1050, 1065, 1095, and 4320 steels. Permeation, diffusion and solubility permeters were determined for gas phase hydrogen transport between pressures of 1.013 x 10 to the 5th power and 4.052 x 10 to the 5th power/sq Nm and temperatures of 250-600 C. Effect of heat treatment on these parameters was studied for quench and tempered spheroidized and normalized 1065 steels. Effect of hydrogen charging at pressures between 6.897 x 10 to the 5th power/sq Nm and temperatures of 350 C, 450 C and 550 C on absorption transients in SAE 1010 and 1095 Steels was also investigated. Pressure dependence measurements established that lattice diffusion was controlling transport and Sievert's law was applicable for correlating data. Experimental results are consistent with hydrogen trapping at carbide interfaces. Dissert. Abstr.

N79-20212 Cincinnati Univ., Ohio.
A STUDY OF THE EXTRUSION CENTRAL BURST DEFECT Ph.D. Thesis
Ferdinand J. Gurney 1978 213 p
Avail: Univ. Microfilms Order No. 7904731

An examination of the extrusion central burst defect was made using 7075-T651 aluminum alloy at 300 F (422 K). The investigation incorporated the effects of process variables and metallurgical variables. Process variables investigated were ram speed, reduction ratio, conical die angle and friction. Metallurgical variables investigated were heat-to-heat effects, inclusion content and flow strength. Investigation of these variables revealed that the peak value of the true stress-true strain relation of the material played the significant role in the establishment of the tangential velocity discontinuity which led to the central burst defect. Dissert. Abstr.

N79-20213 California Univ., Berkeley.
POWER METALLURGICAL PROCESSING OF MAGNETOSTRICTIVE MATERIALS BASED ON RARE EARTH-IRON INTERMETALLIC COMPOUNDS Ph.D. Thesis
Manoochehr Malekzadeh 1978 106 p
Avail: Univ. Microfilms Order No. 7904541

Procedures are described for fabrication of high density rare earth-iron magnetostrictive compounds by powder metallurgical techniques. The fabrication involves a sequence of steps which includes preparing the pre-alloyed compounds, pulverizing them into a fine powder, compacting in suitable sizes and shapes, and sintering. Samples prepared by these procedures are carefully characterized by scanning electron microscopy, X-ray diffraction, dilatometry, and magnetic measurements. Process steps are found to exert important influence upon densities, microstructure and magnetic properties attained after densification. Investigations on a number of these process steps, including milling time and medium, sintering, and magnetic powder alignment are described. Dissert. Abstr.

N79-20214 Marquette Univ., Milwaukee, Wis.
FATIGUE BEHAVIOR OF A QUENCHED AND TEMPERED Nb-BEARING HSLA STEEL Ph.D. Thesis
Sook In Kwun 1978 209 p
Avail: Univ. Microfilms Order No. 7905176

The effect of the introduction of fine coherent NbC precipitates into a quenched and tempered martensitic HSLA steel on overall fatigue behavior, including low cycle fatigue resistance and resistance to crack initiation and crack propagation, was investigated. Two different microstructures with the same yield strength were produced by different heat treatments; i.e. one microstructure (40H5 heat treatment) had a conventional quenched and tempered martensitic structure while the other one (55H10 heat treatment) contained fine coherent NbC precipitates in a tempered martensitic structure. During low cycle fatigue tests at constant strain amplitude of 0.02, both heat treatments showed cyclic softening; however, the 40H5 heat treatment softened to a greater extent. It was also shown that the 40H5 heat treatment had better low cycle fatigue resistance than the 55H10 heat treatment. Dissert. Abstr.

N79-20215 Utah Univ., Salt Lake City.
STRUCTURE AND PROPERTIES OF THERMOMECHANICALLY TREATED EUTECTOID STEEL Ph.D. Thesis
Alwilson DeJesus Querales 1978 203 p
Avail: Univ. Microfilms Order No. 7906150

The work aimed at producing high-strength, fully pearlitic steel with high ductility and superior fatigue behavior by a thermomechanical treatment (TMT) technique. By producing alignment of the cementite fibers in a soft ferrite matrix, the beneficial effects of fiber strengthening are obtained without the brittleness of a cold worked matrix. A wide schedule of TMT was performed in which the three main parameters: percent cold rolling, time and temperature of rapid annealing were varied. 75 percent cold rolling, followed by a rapid reheat, produced impressive improvements in all the tensile properties. The TMT involving lower annealing temperatures for short times were found to have improved fatigue strength over both random coarse pearlite and 75 percent cold rolled material. Such material also had a higher fatigue ratio value and optimum fatigue behavior on the basis of normalized S/N curves. TMT process developed anisotropy in the fatigue behavior in that transverse samples showed better fatigue strength than longitudinal ones. Dissert. Abstr.

N79-20216*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CRITICAL MASS FLUX THROUGH SHORT BORDA TYPE INLETS OF VARIOUS CROSS SECTIONS
R. C. Hendricks and N. P. Poolos (Lake Ridge Academy, North Ridgeville, Ohio) 1979 26 p refs To be presented at the 15th Intern. Congr. of Refrigeration, Venice, 23-29 Sep. 1979; sponsored by the Intern. Inst. of Refrigeration
(NASA-TM-79017; E-9868) Avail: NTIS HC A03/MF A01 CSCL 11F

Mass flux measurements associated with chocked flows through four Borda type inlet geometries: circular, square, triangular and rectangular (two-dimensional) and two sharp edged geometries taken over a very wide range of inlet stagnation conditions. The measurements indicate that: (1) the mass flux is independent of the inlet cross-section geometry and (2) the mass flux is dependent only on the inlet stagnation conditions. Also by using choked flow results found in the literature, the reduced mass flux is independent of working fluid. Two implications are drawn which remain to be verified: (1) since seal leak rates are weakly dependent on geometry but pressure distribution is strongly dependent on geometry, seal design efforts should be directed more toward controlling the dynamics, and (2) high-L/D ducts of arbitrary cross section and Borda type inlets can possess free jets. L.S.

N79-20217*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF A BRAYTON CYCLE RECUPERATOR AFTER 21,000 HOURS OF GROUND TESTING
Thomas J. Moore Feb. 1979 28 p refs
(NASA-TM-79091; E-9915) Avail: NTIS HC A03/MF A01 CSCL 11F

A metallographic examination was conducted on a Brayton cycle recuperator and associated ducting after 21,000 hours of ground testing in air. At the hot (turbine) end, the recuperator operated at a nominal temperature of 675 C. The type 347 stainless-steel recuperator performed satisfactorily in the ground test even though the primary working fluid leaked to the atmosphere periodically. The leakage path was located at plate-bar braze joints which cracked as a result of thermal stresses. The welded type 347 stainless steel ducting a type 347/Hastelloy X bellows survived the ground test with no apparent loss of ductility or integrity. Some apparent aging embrittlement was observed in the Hastelloy X ducting but the serviceability was not affected. Author

N79-20218*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERIZATION OF DEFECT GROWTH STRUCTURE IN ION PLATED FILMS BY SCANNING ELECTRON MICROSCOPY
Talivaldis Spalvins 1979 12 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 23-37 Apr. 1979; sponsored by Am. Vacuum Soc.
(NASA-TM-79110; E-9528) Avail: NTIS HC A02/MF A01 CSCL 11F

Copper and gold films (0.2 to 2 microns) were ion plated onto polished 304-stainless-steel surfaces. These coatings were examined by scanning electron microscopy for coating growth defects. Three types of defects were distinguished: nodular growth, abnormal or runaway growth, and spits. The cause and origin for each type of defect was traced. Nodular growth is primarily due to inherent substrate microdefects, abnormal or runaway growth is due to external surface inclusions, and spits are due to nonuniform evaporation. All these defects have adverse effects on the coatings. They induce stresses and produce porosity in the coatings and thus weaken their mechanical properties. Friction and wear characteristics are affected by coating defects, since the large nodules are pulled out and additional wear debris is generated. Author

N79-20219*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
THE kW POWER MODULE EVOLUTION STUDY: EXECUTIVE SUMMARY
27 Feb. 1979 48 p refs
(Contract NAS8-32928)
(NASA-CR-161182; LMSC-D614949) Avail: NTIS HC A03/MF A01 CSCL 11F

Using the Marshall Space Flight Center 25 kW Power Module (PM) reference design as a point of departure, the study defined evolutionary growth paths to 100 kW and above. A recommended development approach and initial configurations were described. Specific hardware changes from the reference design are recommended for the initial PM configuration to ensure evolutionary growth, improved replicability, and reduced cost. Certain functional changes are also recommended to enhance system capabilities. L.S.

N79-20220*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHERENCE OF SPUTTERED TITANIUM CARBIDES
William A. Brainard and Donald R. Wheeler 1979 10 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 23-27 Apr. 1979
(NASA-TM-79117; E-9950) Avail: NTIS HC A02/MF A01 CSCL 11F

Sputtered coatings of the refractory metal carbides are of great interest for applications where hard wear-resistant materials are desired. The usefulness of sputtered refractory carbides is often limited, in practice, by spalling or interfacial separation. In this work improvements in the adherence of refractory carbides on iron, nickel and titanium based alloys were obtained by using oxidation, reactive sputtering or sputtered interlayers to alter the coating-substrate interfacial region. X-ray photoelectron spectroscopy and argon ion etching were used to characterize the interfacial regions, and an attempt was made to correlate adherence as measured in wear tests with the chemical nature of the interface. Author

N79-20221*# Minnesota Univ., Minneapolis.
WHISKERS, CONES AND PYRAMIDS CREATED IN SPUTTERING BY ION BOMBARDMENT Final Report
G. K. Wehner Mar. 1979 47 p refs
(Grant NsG-3041)
(NASA-CR-159549) Avail: NTIS HC A03/MF A01 CSCL 11F

A thorough study of the role which foreign atoms play in cone formation during sputtering of metals revealed many experimental facts. Two types of cone formation were distinquished, deposit cones and seed cones. Twenty-six combinations of metals for seed cone formation were tested. The sputtering yield variations with composition for combinations which form seed cones were measured. It was demonstrated that whisker growth becomes a common occurrence when low melting point material is sputter deposited on a hot nonsputtered high melting point electrode. G.Y.

N79-20222*# General Electric Co., Schenectady, N. Y.
EVALUATION OF AN ADVANCED DIRECTIONALLY SOLIDIFIED GAMMA/GAMMA'-ALPHA Mo EUTECTIC ALLOY
M. F. Henry, M. R. Jackson, M. F. X Gigliotti, and P. B. Nelson Jan. 1979 67 p refs
(Contract NAS3-20383)
(NASA-CR-159416; SRD-78-191) Avail: NTIS HC A04/MF A01 CSCL 11F

An attempt was made to improve on the properties of the candidate jet engine turbine blade material AG-60, a gamma/gamma prime-alpha Mo eutectic composite. Alloy 38 (AG-170) was evaluated in the greatest detail. This alloy, Ni-5.88 A1-29.74 Mo-1.65 V-1.2C Re (weight percent), represents an improvement beyond AG-60, based on mechanical testing of the transverse and/or longitudinal orientations over a range of temperatures in tension, shear, rupture, and rupture after thermal exposure. It is likely that other alloys in the study represent a similar improvement. G.Y.

N79-20223# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
THIXOCASTING STEEL PARTS Final Report, 1 Apr. 1977 - 30 Jun. 1978
M. C. Flemings, John F. Boylan, and Richard L. Bye Sep. 1978 140 p refs
(Contract DAAG46-77-C-0033; DA Proj. 1L1-62105-AH-84)
(AD-A063070; AMMRC-TR-78-41) Avail: NTIS HC A07/MF A01 CSCL 11/6

This report describes the Thixocasting process as applied to the die casting of small, AISI 4340 parts. 2,200 shots of semi-solid AISI 4340 were cast in an industrial die casting machine to investigate the feasibility of the Thixocast process for this low alloy steel. The Thixocastings produced demonstrate good quality with radiographic examination showing low porosity levels. The rheological behavior of Rheocast AISI 4340 is qualitatively similar to that of other alloys previously studied. Thus, the viscosity of a Rheocast AISI 4340 slurry increases with increasing fraction solid, and at a given fraction solid, it increases with increasing solidification rate and decreasing shear rate. GRA

N79-20224# South Dakota School of Mines and Technology, Rapid City. Div. of Engineering.
AN INVESTIGATION OF THE INFLUENCE OF SHOCK-WAVE PROFILE ON THE MECHANICAL AND THERMAL RESPONSES OF POLYCRYSTALLINE IRON Final Technical Report, 5 Apr. 1976 - 16 Jul. 1978
G. A. Stone, G. T. Gray, A. R. Pelton, and R. N. Orava 30 Sep. 1978 146 p refs
(Grant DAAG29-76-G-0181)
(AD-A062264; ARO-12800.2-MSX) Avail: NTIS HC A07/MF A01 CSCL 11/6

An investigation was conducted to determine the relative influence of shock-wave parameters on the strengthening of Magnetic Ingot Iron and AISI 1008 Steel. The independently-varied shock-wave parameters include peak pressure, peak pressure duration, and rarefaction rate. Eighteen shock-loading conditions were studied with peak pressures of 8, 10, 13, 18, 25 and 35 GPa. As peak pressure was increased, an increase of the 0.2% off-set yield stress, hardness, twin density and the degree of room temperature strain aging was observed. An increase of pulse duration caused an increase of twin volume fraction, yield strength, and strain aging. Rarefaction rate was found to produce no systematic changes in structure or properties. GRA

N79-20225# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
REFLECTANCE MAP TECHNIQUES FOR ANALYZING SURFACE DEFECTS IN METAL CASTINGS
Robert J. Woodham Jun. 1978 204 p refs
(Contracts N00014-77-C-0389; N00014-75-C-0643)
(AD-A062177; AI-TR-457) Avail: NTIS HC A10/MF A01 CSCL 20/6

This report explores the relation between image intensity and object shape. It is shown that image intensity is related to surface orientation and that a variation in image intensity is related to surface curvature. Computational methods are developed which use the measured intensity variation across surfaces of smooth objects to determine surface orientation. The visual inspection of surface defects in metal castings is considered. Two casting applications are discussed. The first is the precision investment casting of turbine blades and vanes for aircraft jet engines. In this application, grain size is an important process variable. The existing industry standard for estimating the average grain size of metals is implemented and demonstrated on a sample turbine vane. Grain size can be computed from the measurements obtained in an image, once the foreshortening effects of surface curvature are accounted for. The second is the green sand mold casting of shuttle eyes for textile looms. Here, physical constraints inherent to the casting process translate into constraints on the surface topography of cast objects. In order to exploit these constraints, it is necessary to interpret features of intensity as features of object shape. Both applications demonstrate that successful visual inspection requires the ability to interpret observed changes in intensity in the context of surface topography. The theoretical tools developed in this report provide a framework for this interpretation. GRA

N79-20226# Houston Univ., Tex. Dept. of Physics.
INVESTIGATION OF THE INITIATION OF SOLID STATE STRUCTURAL PHASE TRANSFORMATIONS AT CRYSTAL SURFACES BY LOW-ENERGY ELECTRON DIFFRACTION (LEED) Final Report, 1 Jun. 1975 - 31 Aug. 1978
A. Ignatiev Oct. 1978 7 p refs
(Grants DAAG29-75-G-0167; DAAG29-77-G-0162)
(AD-A062127; ARO-12687.5-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

This is a report on the LEED investigations of the role of a free surface in the initiation of Martensitic phase transformations where restricted to principally cobalt surfaces and iron and titanium surfaces. The aim was to study the possible occurrence of surface localized soft phonon modes active in nucleation, however, it was first determined by LEED studies of both pre and post transformed cobalt that the traditional operational nucleation mechanism localized to a surface (surface localized 'frozen in' embryos or nuclei) and proposed faulting mechanisms were unapplicable to the cobalt system. Detailed low-energy electron-diffraction (LEED) work on the (0001) surface of cobalt has indicated no existence of surface localized different phases or embryos that could act as nuclei for the martensitic transformation. The atomic structure of the cobalt surface was shown to be eqivalent to that of the bulk in both the high temperature and low temperature phases. The soft-mode idea could therefore be examined by LEED in detail as a viable mechanism for martensitic transformation nucleation at the surface of cobalt and other transforming materials. Author (GRA)

N79-20227# National Bureau of Standards, Washington, D. C. Surface Science Div.
INFRARED SPECTRA OF CHEMISORBED CO ON Rh Interim Report
J. T. Yates, Jr., T. M. Duncan, S. D. Worley, and R. W. Vaughanuapr 1 Nov. 1978 31 p refs
(Contracts N00014-78-F-0008; N00014-75-C-0960)
(AD-A062248; TR-8) Avail: NTIS HC A03/MF A01 CSCL 07/3

The chemisorption of CO on transition metals has been studied

by many physical techniques in an effort to understand the molecular and electronic character of the adsorbed species. The surface measurement techniques at our disposal range from those useful for studying adsorbed layers on single crystal surfaces to other techniques which may be more readily applied to metal adsorbents which are highly dispersed on inert, high area, supports. It is the latter class of surfaces which more closely resemble heterogeneous catalysts used in practice, and in fact the ability to disperse precious metals has been of major importance in enhancing their usefulness as catalysts. While the study of single crystal adsorbents represents a limit of refinement in one direction (e.g., high-purity substrates, well-defined atomic periodicity and electronic character, etc.), dispersed metal catalysts can in principle achieve a limiting case in the opposite direction (atomic dispersal to the limit of single isolated metal atoms). Comparisons between chemisorbed CO on single metal atoms (or small metal clusters) and the vast literature of metal carbonyl chemistry have often been made. Such comparisons are often extended to single crystals containing chemisorbed CO. GRA

N79-20228# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
AEROSPACE STRUCTURAL METALS HANDBOOK. VOLUME 5, SUPPLEMENT 11: NONFERROUS ALLOYS Quarterly Report, Dec. 1978
S. S. Manson Dec. 1978 74 p Suppl. to AFML-TR-68-115 Volume 1-4
(AD-A062553; AFML-TR-68-115-Vol-5-Suppl-11) Avail: NTIS HC A04/MF A01 CSCL 11/6

This nickel-base alloy, containing large additions of aluminum and titanium, achieves very high strength at elevated temperature. It has thus received considerable attention for application in components of high performance jet engines such as turbine blades, vanes and nozzles, and even integral turbine wheels. Because of the large quantities of strengthening elements included in the composition, the alloy is not hot worked, and is therefore used in the as-cast condition. Recently, however, there has been considerable development of a powder metallurgy product which permits working of the alloy. At high temperatures the powder-consolidated product becomes superplastic, thus opening many possibilities in fabrication-to-shape of wrought complex components. GRA

N79-20229# United Technologies Corp., East Hartford, Conn.
FEASIBILITY STUDIES OF AN ELECTROCHEMICAL TEST METHOD FOR NITROGEN TETROXIDE COMPATIBILITY TESTING Progress Report, Mar. - May 1978
C. T. Brown Nov. 1978 25 p refs
(Contract F04611-77-C-0020)
(AD-A062475; AFRPL-TR-78-72) Avail: NTIS HC A02/MF A01 CSCL 07/2

The application of the electrochemical compatibility test method to metals exposed to nitrogen tetroxide (N_2O_4) is described. It was determined that N_2O_4 is not sufficiently conductive to permit electrochemical measurements to be carried out. It was necessary to add water in the concentration range of ten to eleven value percent in order to obtain compatibility data. This concentration corresponds to the high density acid phase of the N_2O_4 - H_2O system. Above one to two value percent water a small portion of the high density acid phase is formed which can produce localized corrosion. It is suggested that corrosion in the high acid phase should be considered for further study even though the overall water concentration is quite low. Author (GRA)

N79-20230# Ohio State Univ. Research Foundation, Columbus.
SURFACE ENERGIES AND RELATED PROPERTIES OF BETA-TITANIUM ALLOYS Final Report, 1 Jan. 1975 31 Aug. 1978
Glyn Meyrick and Rudolph Speiser 1 Nov. 1978 35 p
(Grant AF-AFOSR-2799-75)
(AD-A062604; OSURF/760216/784090; AFOSR-78-1520TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The original aim of this research program was to measure surface and grain boundary energies in B-titanium alloys; namely Ti-Mo and Ti-V in the pure state and also when containing trace amounts of the elements of group B. The technical reasons for such an investigation have been set forth in detail previously. The preliminary results were promising but as events transpired the surface energy of vanadium could not be satisfactorily determined by the zero-creep method within the time allotted. However, the second phase of the program was very successful. This investigation, which began by exploring means of sensitively measuring creep rates in-situ and at temperature, led to the invention of a new method for determining surface energies called the strain-load relaxation technique. The associated instrumentation was developed and the validity of the method proven using copper. In the final analysis, the creation of the technique which will permit the evaluation of surface energies more rapidly and more accurately than has been previously possible is a more significant advance than would have been achieved merely by the successful completion of the zero-creep experiments. GRA

N79-20231# American Univ., Washington, D. C. Dept. of Chemistry.
CONTROL OF STRESS CORROSION CRACKING BY INHIBITORS (A REVIEW OF THE LITERATURE) Technical Progress Report
Charles S. Odell and B. F. Brown Oct. 1978 21 p refs
(Contract N00014-75-C-0799)
(AD-A062500; TR-8) Avail: NTIS HC A02/MF A01 CSCL 11/6

Studies of inhibitors of stress corrosion cracking (SCC) are reviewed for austenitic stainless steels, brass, titanium, aluminum alloys, and carbon and low alloy steels. There are at least five combinations of alloy and environment for which inhibitors have provided engineering solutions for the control of SCC, and others are not improbable at an early date. In view of the complexity of the problem and the comparatively few sustained research programs in this special field, it is not surprising that the fundamentals of inhibition of SCC are incompletely understood. Author (GRA)

N79-20232# Rutgers - The State Univ., Piscataway, N. J. Dept. of Mechanics and Materials Science.
X-RAY DOUBLE-CRYSTAL DIFFRACTOMETER DETERMINATION OF EXCESS DISLOCATION DENSITIES OF SURFACE LAYER AND BULK IN STRESS CORROSION CRACKING Interim Technical Report, 1 Feb. 1977 - 30 Nov. 1978
S. Weissmann, R. Yazici, T. Tsakalakos, and I. R. Kramer 1 Dec. 1978 38 p refs
(Contract N00014-77-C-0191)
(AD-A062162; ITR-1) Avail: NTIS HC A03/MF A01 CSCL 11/6

The excess dislocation densities in surface layer and bulk of 304 stainless steel and titanium aluminum alloys were determined by X-ray rocking curve measurements combined with X-ray topography. Up to a critical density of excess dislocations, the surface layer exerted a barrier effect on the egression of excess dislocations from the bulk. When this critical value was exceeded, macroscopic mechanical instability set in. Methods were presented to predict the stress corrosion lifetime of alloys by non-destructive X-ray measurements. Author (GRA)

N79-20233# Naval Research Lab., Washington, D. C.
A CORRELATION BETWEEN SCC PATH, HARDNESS, MICROSTRUCTURE, AND MICROSEGREGATION IN HY-130 E14108 WELD METAL
F. W. Fraser, E. A. Metlbower, and J. Stoop 22 Dec. 1978 21 p refs
(AD-A063133; NRL-8193) Avail: NTIS HC A02/MF A01 CSCL 11/6

In an investigation of cold cracking in the weld metal of an HY-130 E14018 weldment, variations in hardness, microstructure, and microsegregation were related to the path of the fracture which propagated through the centers of adjacent weld beads. Evidence of solute rejection was found in the formation of pools of solute, in the cell boundaries, where a transition from a cellular to a cellular-dendritic solidification mode had taken place. The composition of the solute pools was determined by microprobe analysis. Microhardness measurements showed a gradient within each weld bead, with hardness increasing from the fracture edge to the fusion zone at the interface of the weld metal and the base metal. Metallographic examination showed the microstructure at the fracture edge to be largely bainitic, whereas the harder

weld metal, near the fusion zone, was predominantly martensitic. Measurements within the fusion zone showed a slight decrease in hardness, and microprobe analysis showed this to be a zone of melted but incompletely mixed base metal and weld filler metal. Author (GRA)

N79-20234# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
MICROSTRUCTURAL CHANGES FOLLOWING DEFORMATION OF Ti-6Al-4V Final Scientific Report, 15 Sep. 1977 - 14 Sep. 1978
Abraham Rosen 25 Oct. 1978 14 p refs
(Grant AF-AFOSR-3441-77)
(AD-A063085; EOARD-TR-78-4) Avail: NTIS HC A02/MF A01 CSCL 11/6

Creep tests have been performed in the range 800-900 C on thin specimens of commercially pure titanium. It was observed that, in the temperature range of interest, the mode of failure was strongly dependent upon the imposed creep rate. Transmission electron microscopy revealed that recrystallization occurred during high creep rate deformation and that the recrystallization nuclei often occurred at grain boundary triple points where the dislocation density was relatively high. By contrast in low creep rate experiments there was no evidence of large scale recrystallization or grain boundary migration but dislocation climb appeared to be an important factor in creep in this region. Author (GRA)

N79-20235# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
FATIGUE CRACK PROPAGATION IN Ti ALLOYS Final Report, 1 Oct. 1973 - 30 Sep. 1978
Donald A. Koss 25 Oct. 1978 37 p refs
(Grant AF-AFOSR-2596-74)
(AD-A062771; AFOSR-78-1517TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The influence of microstructure, slip behavior, and gaseous environment on the fatique crack propagation of Ti alloys has been investigated. Large grain or single crystal material has been used extensively in order to ensure that the crack-tip plasticity is smaller than the scale of the microstructure. As a result, extensive Stage 1 crack propagation occurs. The experimental relationships between crack-tip plasticity, orientation of the crack plane to the stress axis, fractography, and the resulting fatigue crack growth behavior are presented. Several Ti alloys are examined in lab air, dry helium, or hydrogen environments: beta-phase Ti-40V, metastable beta Ti-27V, and Ti-30V, alpha-phase Ti-4Al, and the alpha-beta alloy, Ti-8Al-1Mo-IV. The behavior of the beta Ti alloys can be analyzed primarily in terms of crack advance by an intersecting slip process resulting from flow on at least two active slip systems. In contrast, the mechanism for Stage 1 fatigue in alpha and alpha - beta Ti alloys appears to be dominated by basal slip and strongly influenced by environment. Aspects of the cyclic stress-strain behavior of beta and alpha - beta Ti alloys are also reported. In addition, strengthening of Ti alloys by eutectoid decomposition is briefly discussed. Author (GRA)

N79-20236# Army Materials and Mechanics Research Center, Watertown, Mass.
SEGREGATION IN INGOTS OF LEAN URANIUM ALLOYS Final Report
Stuart V. Arnold and Russell G. Hardy Sep. 1978 22 p
(AD-A063021; AMMRC-TR-78-52) Avail: NTIS HC A02/MF A01 CSCL 11/6

Heats of three depleted uranium alloys were melted to nominal compositions as follow: (1) U-0.75%Ti; (2) U-0.75%Mo-0.75%Nb-0.75%Zr-0.3%V-0.5%Ti; (3) U-0.85%Mo-0.85%Nb-0.5%Ti. The heats were vacuum-induction-melted in a zirconia-washed graphite crucible and bottom-poured into zirconia-washed graphite molds to produce 4.5-inch-diameter ingots weighing 220 pounds each. Chemical analyses from center, midradius, and surface locations at bottom and top of billets removed from these ingots are reported. Results of scanning for evidence of microsegregation (coring) with an electron probe are discussed. Author (GRA)

N79-20237# Duke Univ., Durham, N. C. Dept. of Mechanical Engineering and Material Science.
A FUNDAMENTAL STUDY OF PRECIPITATES AND THE INFLUENCE OF THE CRYSTAL STRUCTURE ON THE STRENGTH OF AGE-HARDENABLE ALUMINUM-LITHIUM ALLOYS Final Report, 25 Nov. 1977 - 23 Nov. 1978
Marion L. Shepard and Franklin A. Cocks Nov. 1978 10 p refs
(Grant DAAG29-78-G-0034)
(AD-A063005; ARO-15652.1-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

From the results obtained in this study, it is apparent that A1-Cu-Li alloys are amenable to electrochemical extraction. A combination of extracting to a powder and x-ray diffractometer scanning should produce optimum results. Confirmation of this should then allow a determination of the effects of minor alloying additions on the precipitated phases in A1-Cu-Li and A1-Li alloys, an evaluation of the sequential development of these phases during age-hardening as a function of both lithium content and aging temperature, and an assessment of the influence of the precipitates, as well as insolubles and dispersoids, on fracture toughness. Author (GRA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N79-20238 Northeastern Univ., Boston, Mass.
STRUCTURAL, THERMAL, AND MAGNETIC PROPERTIES OF METASTABLE ALLOYS, ESPECIALLY BINARY ZIRCONIUM-COPPER AND TERNARY ZIRCONIUM-COPPER METALLIC GLASSES Ph.D. Thesis
Ramaswamy Venkata Raman 1977 202 p
Avail: Univ. Microfilms Order No. 7904167

Metallic glasses can be retained in the Zr-Cu system over a large composition range covering almost one half of the total range. The glass transition temperature T sub g shows a monotonic increase with increasing Cu content in the range of 30 to 65 atomic percent Cu; T sub c, however, reaches a maximum at 65 at percent Cu and decreases with a further increase in the Cu content. The effect of first row transition metals, non-transition metals, and metalloids on the thermal stability of a Zr.50Cu.50 glass was investigated. Sc and Ti are seen to cause destabilization, the rest of the first row transition metals cause a moderate to substantial increase in thermal stability, and non-transition metals and metalloids cause a substantial increase in stability. Al is seen to cause the maximum increase in stability of all the additives tested. Magnetic susceptibility measurements on amorphous Mg-Zn alloys show that these alloys posses temperature-independent Pauli paramagnetism, with susceptibilities ranging from 5.0-10 to the 6th power emu/g-atom for Mg(.75)Zn(.25) to about 2.6-10 to the 6th power emu/g-atom for Mg(.68)Zn(.32). Dissert. Abstr.

N79-20239*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
A FUNDAMENTAL APPROACH TO ADHESION: SYNTHESIS, SURFACE ANALYSIS, THERMODYNAMICS AND MECHANICS Final Report
Wen Chen and James P. Wightman Jan. 1979 130 p refs
(Grant NsG-1124)
(NASA-CR-158438) Avail: NTIS HC A07/MF A01 CSCL 11A

Adherend surfaces and fractography were studied using electron spectroscopy for chemical analysis and scanning electron microscopy/energy dispersive analysis of X-rays. In addition, Auger Electron Spectroscopy with depth profiling capability was used. It is shown that contamination of adhesion systems plays an important role not only in determining initial bond strengths but also in the durability of adhesive bonds. It is concluded that the analytical techniques used to characterize and monitor such contamination. M.M.M.

N79-20240*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIDE-TEMPERATURE-SPECTRUM SELF-LUBRICATING COATINGS PREPARED BY PLASMA SPRAYING

Harold E. Sliney 1979 10 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 23-27 Apr. 1979; cosponsored by the Am. Vacuum Soc. and the Am. Soc. for Metals
(NASA-TM-79113; E-9945) Avail: NTIS HC A02/MF A01 CSCL 11H

Self-lubricating, multicomponent coatings, which lubricate over a wide range of operating conditions, are described. The coatings were successfully applied by plasma-spraying mixed powders onto superalloy substrates. They were evaluated in friction and wear experiments, and in sliding contact bearing tests. These coatings are wear resistant by virtue of their self lubricating characteristics rather than because of extreme hardness; a further benefit is low friction. Experiments with simple pin on disk sliding specimens and oscillating plain cylindrical bearing tests were performed to evaluate the tribological properties of the coatings. It was shown that coatings of nichrome, glass and calcium fluoride are self-lubricating from about 500 to 900 C, but give high friction at the lower temperatures. The addition of silver to the coating composition improved the low temperature bearing properties and resulted in coatings which are self-lubricating from cryogenic temperatures to at least 870 C; they are therefore, wide temperature spectrum, self-lubricating compositions. L.S.

N79-20241*# National Aeronautics and Space Administration, Washington, D. C.
PSP RESINS, NEW MATERIALS WHICH CAN BE HARDENED BY THERMAL TREATMENT FOR USE IN COMPOSITE MATERIALS RESISTANT TO HEAT AND FIRE
M. Ropars, B. Bloch, and B. Malassine Apr. 1979 20 p Transl. into ENGLISH of conf. paper ONERA-TP-1978-23, Paris, 1978 9 p Presented at the 5th Conf. Europeene des Plastiques et Caoutchoucs, Paris, 12-15 Jun. 1978 Original language document was announced as A78-45284 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by SNPE Bouchet Res. Center (France)
(Contract NASw-3199)
(NASA-TM-75415; ONERA-TP-1978-23) Avail: NTIS HC A02/MF A01 CSCL 11G

A class of easy-to-prepare heterocyclic-aromatic polymers which can be used for matrices in reinforced laminates is described. These polymers can be cured after B-staging with very little evolution of volatile materials, and they retain a low melt-viscosity which leads to low-void laminates. Resins are stable at temperatures below 150 C. Properties of composites with various reinforcements, in particular carbon-fiber unidirectional laminates, are described, and the fire behavior of PSP-glass laminates is reported. L.S.

N79-20242# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
SINTERABLE POWDERS FROM LASER DRIVEN REACTIONS Status Report, 1 Jul. 1977 - 30 Jun. 1978
John S. Haggerty and W. Roger Cannon Oct. 1978 84 p refs
(Contract N00014-77-C-0581; ARPA Order 3449)
(AD-A063064; MIT-EL-78-037) Avail: NTIS HC A05/MF A01 CSCL 11/2

Novel methods for producing ideal powders for fabricating Si3N4 ceramic parts have been investigated. The characteristics sought were principally uniformly small diameter, equiaxed, high purity particles which are free of agglomerates. Two laser processes were studied. In the first, a CO2 laser source was used to heat the reactant gases by coupling directly to them. Silicon (Si) and Si3N4 powders have been synthesized directly from SiH4 and NH3/SiH4 mixtures, respectively. The spatially well-defined reaction zone and the combination of the rapid heating rates with the short times at reaction temperatures yielded very uniform and small diameter particles. Si3N4 powders were produced with particle diameters entirely within the range of 100-200 A. The particles are equiaxed and nearly spherical. The Si powders had the same general characteristics, but exhibited a slightly larger range of diameters. The second process uses selective heating to reduce the size of oversized particles or agglomerates as well as modifying the shape of high aspect ratio particles. This process is based on the decreasing absorption efficiency of a particle to light when its diameter is less than the wavelength of the incident light. Light induced comminution was demonstrated. We have successfully demonstrated both processes for producing superior Si and Si3N4 powders. GRA

N79-20243# Environmental Research Inst. of Michigan, Ann Arbor.
THERMOPLASTIC MODULATOR DEVELOPMENT Final Technical Report, 11 Apr. 1977 - 11 Jan. 1978
W. S. Colburn, C. C. Aleksoff, and I. Cindrich Wright-Patterson AFB, Ohio AFAL Jun. 1978 79 p refs
(Contract F33615-77-C-1019; AF Proj. 2001)
(AD-A062660; ERIM-128700-10-F; AFAL-TR-78-86) Avail: NTIS HC A05/MF A01 CSCL 20/6

An analytical and experimental research effort was performed to investigate the application of an existing breadboard thermoplastic modulator to wideband spectrum analysis by means of real-time optical data processing. The objectives of the research were identification of an approach for increasing the cycling rate of the modulator to 10 frames per second and improvement of the modulator bandwidth to 100 MHz. A computer model was established to predict the transient thermal behavior of the thermoplastic substrate under conditions of continuous rapid cycling. The computer analysis revealed that the key parameters are the thermal conductivity of the substrate, the substrate thickness, and the length of the heat pulses. Based on on results of the computer model, the recommended design employs a 6 mm thick sapphire substrate that is heated with 1 msec pulses and that is liquid cooled on the rear surface. The system bandwidth was analyzed in terms of the impulse responses of the subsystems, including the electron beam modulation, the electron beam spot size, and the thermoplastic response. An analysis of the recording duty cycle led to recommended changes to the deflection circuits to increase the recording duty cycle, with a goal of 97%. Modifications to the breadboard thermoplastic modulator included installation of a new input to reduce the impedance mismatch and redesign of the cathode support structure to accommodate new cathodes. Although limited by a 25 micrometer spot size, thermoplastic recordings were achieved at input frequencies of up to 120 MHz. GRA

N79-20244# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
ORGANOSILICON COMPOUNDS AND ORGANOSILICON POLYMER INTERMEDIATES Final Report, 1 Oct. 1975 - 30 Sep. 1978
Dietmar Seyferth 21 Nov. 1978 13 p refs
(Grant AF-AFOSR-2917-76)
(AD-A062733; AFOSR-78-1578TR) Avail: NTIS HC A02/MF A01 CSCL 07/3

A summary of three years of research directed mainly at a development of the chemistry of silacyclopropanesand silacyclopropenes. Author (GRA)

N79-20245# Universal Energy Systems, Inc., Dayton, Ohio.
LARGE VOLUME PLASMA PRODUCTION BY 2.45 GHz MICROWAVES Final Report, 9 Dec. 1974 - 16 May 1977
Rodney Darrah Dec. 1977 97 p refs
(Contract F33615-75-C-1082; AF Proj. 2301)
(AD-A062659; AFAPL-TR-77-85) Avail: NTIS HC A05/MF A01

The ionization and excitation of gases by three different geometries of microwave applicators are investigated. Current-voltage characteristics of a plasma with super-imposed ionization by a 2.45 GHz applicator with transport from a dc field are measured. Electron densities in helium and argon test gases were found to be greater than 10 to the 12th power/cc or thirty times higher than normal plasma cut-off densities. This applicator is also used to determine the percentage of O2a 1 del(g) produced in a pure oxygen microwave discharge. A production of up to 25% at low pressures is measured. A design which specially couples two applicators was implemented resulting in twice the power density and better uniformity. Measurement of the percentage of atomic oxygen produced in an oxygen discharge, determined by NO2 titration, indicates the efficiency of atom production for this system is as high as 43 eV/atom. Microwave power is superimposed on a dc discharge in a quartz tube He-Ne laser in this system. Author (GRA)

N79-20246# Ford Motor Co., Dearborn, Mich.
METHODOLOGY FOR CERAMIC LIFE PREDICTION AND RELATED PROOF TESTING Interim Report, Jan. 1977 Mar. 1978
R. K. Govila Jul. 1978 55 p refs Sponsored in part by DOE
(Contract DAAG46-77-C-0028)
(AD-A062444; AMMRC-TR-78-29) Avail: NTIS HC A04/MF A01 CSCL 11/2

This program consists of a basic study using two potential high temperature ceramic materials, namely, hot pressed silicon nitride NC132 (Norton) and hot pressed silicon nitride made with 3.5 wt. percent MgO (Ford material) to determine the statistical and time dependent strength characteristics related to the presence of subcritical crack growth. The data will be used to correlate analytical ceramic life prediction and possibly verify with experimental results obtained from simple tensile stress rupture tests. Author (GRA)

N79-20247# Arizona Univ., Tucson. Dept. of Chemistry.
ELECTRICAL AND ELECTROCHEMICAL BEHAVIOR OF FILLED POLYMERIC FILMS Final Technical Report, 1 Apr. 1972 - 31 Mar. 1978
Henry Freiser 6 Dec. 1978 22 p refs
(Contract N00014-75-C-0400; NR Proj. 356-532)
(AD-A062341; Rept-6) Avail: NTIS HC A02/MF A01 CSCL 11/9

Electrical conductivity of plasticized polyvinylchloride films containing valinomycin and potassium salts have been measured at various temperatures and pressures in order to obtain the conduction activation energies and volumes. These electrical properties change significantly at the glass transition temperature (Tg) of the polymer. For the first time, a detailed correlation of the Tg and the electrochemical behavior of the K- Valinomycin electrode has been obtained. GRA

N79-20248# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
EFFECTS OF ADHESIVE AND PROCESSING PARAMETERS ON ADHESIVE BONDING OF POLYCARBONATE
David W. Levi, Raymond F. Wegman, Marie C. Ross, William C. Tanner, and Michael J. Bodnar Aug. 1978 24 p refs
(AD-A062087; AD-E400215; ARLCD-TR-78054) Avail: NTIS HC A02/MF A01 CSCL 11/1

The Weibull distribution was found to be quite useful in studying the effects of adhesive and processing parameters on adhesive bonding of polycarbonate. Adhesive selection is very important in satisfactorily bonding this polymer. Ethanol wipe and sanding as surface pretreatments of the polycarbonate appear to be equivalent. The humidity exposure of polycarbonate before and during bonding is briefly discussed. Surface exposure times (SET) of up to 30 days appear not to affect strength of either tested or aged specimens of urethane adhesive bonds. The lower-strength epoxy bonds aged 30 days at 49 C (120 F) and 95% RH lose strength after the 30 day SET. Author (GRA)

N79-20249# Lehigh Univ., Bethlehem, Pa. Materials Research Center.
FATIGUE CRACK PROPAGATION IN POLYMERIC MATERIALS Final Report, 1 Sep. 1973 - 24 Sep. 1978
Richard W. Hertzberg and John A. Manson Nov. 1978 13 p refs
(Grants DAHC04-74-G-0010; DAAG29-76-G-0036)
(AD-A062126; ARO-11180.5-MC; ARO-14409.4-MS) Avail: NTIS HC A02/MF A01 CSCL 11/9

This report summarizes the results of a research program to bring polymer science and fracture mechanics technologies to bear on the subject of polymer fatigue. The first major thrust area concerned an analysis of fatigue fracture micromechanisms in amorphous engineering plastics. Author (GRA)

N79-20250# Tennessee Univ., Knoxville.
STRUCTURAL INVESTIGATIONS OF POLYMER LIQUID CRYSTALLINE SOLUTIONS: AROMATIC POLYAMIDES, HYDROXY PROPYL CELLULOSE, AND POLY (GAMMA-BENZYL-L-GLUTAMATE) Technical Report, 1 Jul. 1977 - 30 Oct. 1978
Yoshihiko Onogi, James L. White, and John F. Fellers 30 Oct. 1978 49 p refs Submitted for publication
(Contract N00014-77-C-0236)
(AD-A062115; PSE-122; TR-3) Avail: NTIS HC A03/MF A01 CSCL 11/9

The development of high levels of chain orientation and tensile strength in fibers obtained from the wet spinning of liquid crystalline aromatic polyamide solutions has gained increased attention in recent years. Various other synthetic polymer systems have been found to exhibit liquid crystalline behavior including polypeptides, certain polyester copolymers, some vinyl polymers and p-linked aromatic polyamide-hydrazides. Various biological polymers such as RNA and DNA have been so identified as well as one modified cellulose. While various investigators have presented studies of the characteristics of individual polymer liquid crystalline systems, there have been no comparative studies of a series of polymer liquid crystalline systems nor detailed comparisons with the well known low molecular weight thermotropic liquid crystalline compounds. Furthermore, since the various systems were studied by different research groups often using different experimental methods, both the relative characteristics and peculiar features of individual systems have not been clearly identified. The purpose of the present paper is to present such a needed comparative study. GRA

N79-20251# Naval Research Lab., Washington, D. C.
AN INVESTIGATION INTO THE CAUSES OF CERAMIC CRACKING IN THE MARK 11 SOURCE (400 SERIES)
R. C. Pohanka, P. L. Smith, and P. C. Miller 7 Dec. 1978 30 p refs
(AD-A062484; NRL-MR-3894) Avail: NTIS HC A03/MF A01 CSCL 11/2

In summary, this investigation has shown that 10% of the Edo-Western ceramics used in the Bendix source are weak, that is, they fail at hoop tensile stresses of 5000 psi or less, and a few fail at stresses as low as 1000 psi. It was found that a proof test of the elements of 6000 psi would eliminate the weak ceramics without damaging the survivors. All in-service failures (from environmental testing or handling) were found to occur in ceramic elements which contained large flaws or other defects. The strength of these was calculated to be 6000 psi or less, and the strength distribution was significantly different from normal Edo-Western ceramics. The fracture of the in-service failed elements was due to hoop tension which arises from the action of the neoprene spacer under axial compression. All service failures occurred either at solder joints or from edge defects at the non-bonded side of the element. GRA

N79-20252# Army Missile Research and Development Command, Redstone Arsenal, Ala. Engineering Lab.
A THERMOMECHANICAL (TMA) TEST METHOD FOR EVALUATION OF CURED POLYMER ENCAPSULATING MATERIALS
Knowlen F. Knowles 5 Oct. 1978 26 p refs
(AD-A062602; DRDMI-E-78-23) Avail: NTIS HC A03/MF A01 CSCL 11/9

Thermomechanical Analysis (TMA) penetration test method was used to measure the softening point temperature of cured polymer encapsulating and coating materials. This test method was compared with the Shore Hardness Test Method by measuring softening temperature and hardness change that occurred in encapsulating materials exposed to humidities greater than 90% and temperatures above 82 C. The thermomechanical test method definitely offers a distinct advantage when evaluating the quality of a manufactured item. The TMA method is very rapid, requires a small amount of test specimen and is nondestructive to the part. Author (GRA)

N79-20253# Yeshiva Univ., New York. Div. of Natural Sciences and Mathematics.
STUDIES IN SECONDARY RELAXATIONS IN GLASSES: INFLUENCE OF ANNEALING ON THE STRENGTHS OF RELAXATIONS Final Report, 1 May 1973 - 31 Oct. 1977
Martin Goldstein 1 Aug. 1978 10 p refs
(Grant AF-AFOSR-2540-73)
(AD-A062617; AFOSR-78-1537TR) Avail: NTIS HC A02/MF A01 CSCL 11/2

In view of a critique by DiMarzio of the standard thermodynamic treatment of the glass transition by Davies and Jones, a reexamination of that treatment was made, and its original

conclusions reaffirmed. Examination of calorimetric data on quenched and annealed glasses and on the crystalline phase shows that a major part of the liquid 'configurational' specific heat and entropy arise from non-configurational factors, specifically a dependence on structural state (Fictive temperature) of (1) lattice vibrational frequencies, (2) anharmonicity, and (3) the numbers of molecular groups capable of participating in secondary relaxational motions. A study of the influence of annealing (as measured by the fictive temperature) on the strength of dielectric loss in glasses was studied on six molecular liquid glass-formers. A remarkable sensitivty of dielectric loss to fictive temperature was found (1-3 per cent per degree fictive). This sensitivity decreased as the temperature of measurement decreased. It was not possible to determine whether the changes in the Beta relaxation region were greater than the changes in the background loss. The thermodynamic implications of these results for the glass transition are pointed out. Author (GRA)

N79-20254# Rensselaer Polytechnic Inst., Troy, N. Y. Lab. for Viscoelasticity.

MEASUREMENT OF PROPERTIES AND RESPONSE FUNCTIONS OF LIQUID LUBRICANTS RELATED TO TRANSIENT VISCOELASTIC REGIMES Final Report, 1 Apr. 1976 - 30 Sep. 1977

Meyer H. Birnboim Jun. 1978 282 p refs
(Contract F33615-76-C-5101; AF Proj. 2303)
(AD-A062612; AFML-TR-78-69) Avail: NTIS HC A13/MF A01 CSCL 11/8

This report is concerned with measurements of the viscoelastic response functions over a wide range of frequency and pressure that are required for the mechanical characterization of lubricating oils. Both rheo-optical (light scattering) and mechanical (ultrasonic) methods are required to obtain the viscoelastic data. Several developmental aspects of the implementation of these techniques as well as some of the results are discussed herein. The emphasis of this report is on: (1) development of techniques required to obtain light scattering from lubricants in the high pressure diamond anvil cell. These low frequency data analyses based on scattering from nonmagnetic and from magnetic spheres suspended in the liquid, and Brillouin line width measurements to yield both elastic modulus and loss of the liquids in the range circa 10 to the 8th power - 10 to the 9th power Hz, (2) preliminary results on steady-state viscosity of the test fluids at atmospheric pressure, (3) new experimental results on the role of additives in determining the viscoelastic response of lubricants. Author (GRA)

N79-20255# Catholic Univ. of America, Washington, D. C. Vitreous State Lab.

INVESTIGATION OF PIEZOELECTRIC EFFECT IN PERMANENTLY POLARIZED OXIDE GLASSES AND GLASS CERAMICS Final Report, Mar. 1975 - Feb. 1978

Joseph H. Simmons, Michael S. Chu, Catherine J. Simmons, and Paul B. Elterman Nov. 1978 106 p refs
(Contract N00014-75-C-0707)
(AD-A063132; FR-2) Avail: NTIS HC A06/MF A01 CSCL 11/2

Experiments are reported which demonstrate the use of phase separated glasses for development of permanently polarized electrets. Investigations of phase separation, dielectric relaxation and electrical conductivity of high silica glasses are presented. This research investigated the possible piezoelectric behavior of oxide glass samples subjected to phase separation and volume polarization. The concept consists of developing a glass composition which, when phase separated, produces a structure made up of isolated spheres within a low conductivity matrix. The conductivity of the spheres needs to be higher than the matrix at high temperatures but both materials must exhibit low conductivity at usage temperature. Thus, at high temperatures it is possible to apply an external electric field and polarize the isolated spheres by bulk ionic diffusion. When the sample is cooled to room temperature with the applied field and the applied field is removed when the sample is cold, a permanent polarization field will remain frozen in the spheres due to their low room temperature conductivity. Such material will exhibit intrinsic polarization and piezoelectic properties. Since the permanent polarization is developed throughout the glass, the piezoelectric behavior is not affected by surface polarization or by chemical reactions on the surface. GRA

N79-20256# Army Materials and Mechanics Research Center, Watertown, Mass.

GRAIN BOUNDARY ENGINEERING IN MONOXIDE CERAMICS

R. Nathan Katz and George E. Gazza Sep. 1978 16 p refs Presented at the 14th Univ. Conf. on Ceramic Sci., at North Carolina State Univ., Raleigh, 7-9 Nov. 1977
(AD-A063110; AMMRC-MS-78-5) Avail: NTIS HC A02/MF A01 CSCL 11/2

The deliberate selection and control of composition, structure, and processes occurring in the grain boundary, both during and after fabrication, with the aim of specific property modification may properly be defined as grain boundary engineering. We will review various strategies for doing grain boundary engineering and give examples of the use of these strategies in the development of hot-pressed silicon nitride. Research needs for further development of grain boundary engineering (GBE) in nonoxide systems are discussed. GRA

N79-20257# Union Carbide Corp., Tarrytown, N.Y.

ORGANOSILANE POLYMERS. 2: COPOLYMERS OF ETHYLMETHYL- AND METHYLPROPYLSILYLENES WITH DIMETHYLSILYLENE

J. P. Wesson and T. C. Williams Dec. 1978 25 p refs
(Contract N00014-75-C-1024)
(AD-A063075; TR-78-1) Avail: NTIS HC A02/MF A01 CSCL 11/9

Random copolymers of ethylmethl- and methylpropylsilylenes with dimethylsilylene prepared by alkali metal coupling of chlorosilanes were found to have improved solvent solubilities. Some copolymers soluble at ambient temperatures in common solvents were obtained but crystallization behavior was not substantially altered. Author (GRA)

N79-20258# National Bureau of Standards, Washington, D. C. Polymer Science and Standards Div.

APPLICATION OF NEW KINETIC TECHNIQUES TO THE LIFETIME PREDICTION OF POLYMERS FROM WEIGHT-LOSS DATA

Joseph H. Flynn and Brian Dickens Sep. 1978 25 p refs
(AD-A063060) Avail: NTIS HC A02/MF A01 CSCL 11/9

Prediction of the lifetime of a polymer by extrapolation of weight-loss data is a tenuous procedure and a thorough analysis of the kinetics over a wide temperature range is a requisite. Several experimental methods and kinetic analytical techniques were developed which are designed to overcome the problems of conventional methods. These include: (1) a factor-jump method in which a fully automated and minicomputer directed system calculates activation energies using one sample and a series of short, isothermal plateaus, this avoids complications from the comparison of samples with diverse properties and thermal histories; (2) a diagnostic test for the consistency of kinetic parameters over a broad region of temperature and conversion; (3) a comparison of experiments performed at constant heating rates from 6 K/min. to 9 K/day, this allows an insight into the mode of kinetic coupling of competing processes and better prediction of the dominant low-temperature process; (4) a detailed analysis of the kinetics of the first several percentages weight-loss at slow heating rates and low temperatures, many polymers lose their useful properties in this region. These methods are being applied to polystyrene and polyurethanes in vacuum, nitrogen, and nitrogen-oxygen mixtures. GRA

N79-20259# National Bureau of Standards, Washington, D. C. Polymer Science and Standards Div.

CRYSTALLINITY IN HYDROLYTICALLY AGED POLYESTER POLYURETHANE ELASTOMERS Technical Report, Jan. - Sep. 1978

Daniel W. Brown, Robert E. Lowry, and Leslie E. Smith Sep. 1978 17 p refs Submitted for publication
(NR Proj. 356-647)
(AD-A063049; TR-1) Avail: NTIS HC A02/MF A01

Several experimental and two commercial polyurethanes were aged in wet air. Polyester types suffered molecular weight degradation but became more crystallizable at 25 C than unaged specimens. Crystallinity contributes to modulus and hardness, and, if measured at 25 C, these properties appear to have been increased by aging. However, at 60 C, 10 C above the crystalline

melting point, the moduli of the wet-aged polyester types are less than those of unaged counterparts, showing the effect of the decreased molecular weight. Earlier assessments of polyurethane stability were based on the mechanical properties of reconditioned samples at room temperature, and this probably caused an overestimate of the lifetime of polyester types. Polyether types showed little change in molecular weight on aging, and remained uncrystallizable. Consequently, aged and unaged polyether types showed the same relative moduli at 25 and 60 C. The commercial polyester type underwent about ten times as many scissions as the polyether type when aged under the same conditions. Author (GRA)

N79-20260# University Coll. of North Wales, Bangor.
A STUDY OF THE NATURE AND ORIGIN OF PYROELECTRICITY AND PIEZOELECTRICITY IN POLYVINYLIDENE-FLUORIDE AND ITS COPOLYMER WITH TETRAFLUOROTHYLENE Annual Technical Report, Sep. 1977 - Aug. 1978
D. K. Das-Gupta Aug. 1978 68 p refs
(Grant DA-ERO-78-G-004; DA Proj. 1T1-61102-BH-57)
(AD-A062759; ATR-1) Avail: NTIS HC A04/MF A01 CSCL 07/4

X-ray diffraction profiles, piezoelectric strain coefficient d31 and the pyroelectric coefficient P3 of 50 microns (Form 2 crystallites only) and 25 microns (both Form 1 and Form 2 crystallites) thick PVF2 films have been studied after (i) corona poling (ii) uniaxial stretching and (iii) uniaxial stretching and corona poling. The results suggest that the induced piezo- and pyroelectricity in PVF2 is of dipolar origin. However, there is a difference in a sense that corona poling alone at fields 1/3 x 10 to the 8th power Vm produces mainly an intermediate polar form of Form 2 crystallites by a co-operative rotation of the alternate polymer chains through 180 degrees about the chain axis (i.e. c-axis) without losing its T-G-T-G: molecular conformation and the unit cell dimensions remaining unaltered. Uniaxial stretching, however, produces a direct conversion to the polar Form 1 type of structure from the non-polar Form 2 crystallites. A study of birefringence and small angle light scattering (SALS) patterns has also been made with uniaxially stretched PVF2 films, originally containing only Form 2 (non-polar) crystallites. The results indicate that the major contribution to the observed orientation, producing Form 1 type polar crystallites, originates from the crystallite regions of the polymer. Author (GRA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N79-20261*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL INVESTIGATION OF FUEL EVAPORATION IN THE VAPORIZING ELEMENTS OF COMBUSTION CHAMBERS
I. Vezhba Feb. 1979 18 p refs Transl. into ENGLISH from Arch. Procesow. Spalania (Poland), v. 1, no. 2, 1970 p 179-190 Original language document was announced as A71-25123 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Aviation, Warsaw
(Contract NASw-3199)
(NASA-TM-75383) Avail: NTIS HC A02/MF A01 CSCL 21D

A description is given of the experimental apparatus and the methods used in the investigation of the degree of fuel (kerosene) evaporation in two types of vaporizing elements in combustion chambers. The results are presented as dependences of the degree of fuel evaporation on the factors which characterize the functioning of the vaporizing elements: the air surplus coefficient, the velocity of flow and temperature of the air at the entrance to the vaporizing element and the temperature of the wall of the vaporizing element. L.S.

N79-20262*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSIENT PROCESSES IN THE COMBUSTION OF NITRAMINE PROPELLANTS Annual Research Progress Report, 1 Oct. 1977 - 30 Sep. 1978
N. S. Cohen (Cohen (Norman) Professional Serv., Redlands, Calif.) and L. D. Strand Nov. 1978 67 p refs
(Contracts NAS7-100; JPL-954985; AFOSR ISSA 78-0004)
(NASA-CR-158418; JPL-Pub-78-108) Avail: NTIS HC A04/MF A01

A transient combustion model of nitramine propellants is combined with an isentropic compression shock formation model to determine the role of nitramine propellant combustion in DDT, excluding effects associated with propellant structural properties or mechanical behavior. The model is derived to represent the closed pipe experiment that is widely used to characterize explosives, except that the combustible material is a monolithic charge rather than compressed powder. Computations reveal that the transient combustion process cannot by itself produce DDT by this model. Compressibility of the solid at high pressure is the key factor limiting pressure buildups created by the combustion. On the other hand, combustion mechanisms which promote pressure buildups are identified and related to propellant formulation variables. Additional combustion instability data for nitramine propellants are presented. Although measured combustion response continues to be low, more data are required to distinguish HMX and active binder component contributions. A design for a closed vessel apparatus for experimental studies of high pressure combustion is discussed. L.S.

N79-20263*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROPELLANT GRAIN DYNAMICS IN AFT ATTACH RING OF SHUTTLE SOLID ROCKET BOOSTER
V. Verderaime Feb. 1979 47 p refs
(NASA-TM-78220) Avail: NTIS HC A03/MF A01 CSCL 21H

An analytical technique for implementing simultaneously the temperature, dynamic strain, real modulus, and frequency properties of solid propellant in an unsymmetrical vibrating ring mode is presented. All dynamic parameters and sources are defined for a free vibrating ring-grain structure with initial displacement and related to a forced vibrating system to determine the change in real modulus. Propellant test data application is discussed. The technique was developed to determine the aft attach ring stiffness of the shuttle booster at lift-off. Author

N79-20264*# National Aeronautics and Space Administration, Washington, D. C.
SOME ASPECTS OF AIRCRAFT JET ENGINE FUELS
R. Bekiesinski Apr. 1979 11 p refs Transl. into ENGLISH from Tech. Lotnicza i Astronautyczna (Warsaw), v. 33, Sep. 1978 p 11-12 Original language document was announced as A79-11368 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75395) Avail: NTIS HC A02/MF A01 CSCL 21D

Technologies are reviewed for improving the thermal stability of jet fuels, with reference to the overheating of fuel tanks in supersonic aircraft. Consideration is given to the development of a jet fuel with high thermal stabiiity by the Polish petroleum industry. G.Y.

N79-20265*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIRFOIL COOLING HOLE PLUGGING BY COMBUSTION GAS IMPURITIES OF THE TYPE FOUND IN COAL DERIVED FUELS
Daniel L. Deadmore and Carl E. Lowell Feb. 1979 14 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-79076; E-9893; DOE/NASA/2593-79/1) Avail: NTIS HC A02/MF A01 CSCL 21D

The plugging of airfoil cooling holes by typical coal-derived fuel impurities was evaluated using doped combustion gases in an atmospheric pressure burner rig. Very high specific cooling air mass flow rates reduced or eliminated plugging. The amount of flow needed was a function of the composition of the deposit. It appears that plugging of film-cooled holes may be a problem for gas turbines burning coal-derived fuels. Author

N79-20266*# General Applied Science Labs., Inc., Westbury, N. Y.

PREMIX FUELS STUDY APPLICABLE TO DUCT BURNER CONDITIONS FOR A VARIABLE CYCLE ENGINE Final Report
K. S. Venkataramani Dec. 1978 44 p refs
(Contract NAS3-20603)
(NASA-CR-159513; TR-251) Avail: NTIS HC A03/MF A01 CSCL 21D

Emission levels and performance of a premixing Jet-A/air duct burner were measured at reference conditions representative of take-off and cruise for a variable cycle engine. In a parametric variation sequence of tests, data were obtained at inlet temperatures of 400, 500 and 600K at equivalence ratios varying from 0.9 to the lean stability limit. Ignition was achieved at all the reference conditions although the CO levels were very high. Significant nonuniformity across the combustor was observed for the emissions at the take-off condition. At a reference Mach number of 0.117 and an inlet temperature of 600K, corresponding to a simulated cruise condition, the NOx emission level was approximately 1 gm/kg-fuel. L.S.

N79-20267# Exxon Research and Engineering Co., Linden, N. J.
HIGH PERFORMANCE, HIGH DENSITY HYDROCARBON FUELS
J. W. Frankenfeld, T. W. Hastings, M. Lieberman, and W. F. Taylor Oct. 1978 239 p refs
(Contract NAS3-20394)
(NASA-CR-159480; EXXON/GRUS.1KWD.78) Avail: NTIS HC A11/MF A01 CSCL 21D

The fuels were selected from 77 original candidates on the basis of estimated merit index and cost effectiveness. The ten candidates consisted of 3 pure compounds, 4 chemical plant streams and 3 refinery streams. Critical physical and chemical properties of the candidate fuels were measured including heat of combustion, density, and viscosity as a function of temperature, freezing points, vapor pressure, boiling point, thermal stability. The best all around candidate was found to be a chemical plant olefin stream rich in dicyclopentadiene. This material has a high merit index and is available at low cost. Possible problem areas were identified as low temperature flow properties and thermal stability. An economic analysis was carried out to determine the production costs of top candidates. The chemical plant and refinery streams were all less than 44 cent/kg while the pure compounds were greater than 44 cent/kg. A literature survey was conducted on the state of the art of advanced hydrocarbon fuel technology as applied to high energy propellents. Several areas for additional research were identified. L.S.

N79-20268# Ballistic Research Labs., Aberdeen Proving Ground, Md.
OBSERVATIONS OF SHAPED-CHARGE JET/M30 PROPELLANT REACTIONS Final Report
J. N. Majerus and A. B. Merendino Sep. 1978 112 p refs
(DA Proj. 1L1-62618-AH-80)
(AD-A062299; AD-E430142; ARBRL-TR-02108) Avail: NTIS HC A06/MF A01 CSCL 19/1

This investigation assesses both the violence of shaped-charge jet/propellant reactions and the pertinent jet-characteristics associated with this violence. The tests involved impacting 105 mm rounds which were instrumented with crush-gages and velocity screens, augmented by framing camera observations (4 microseconds between frames) taken during two tests. The violence of each test was ranked by crush-gage pressures and cartridge-case damage. Test results show that there are 3 types of violence associated with shaped-charge jet/propellant reactions: (1) non-violent, similar to hydrostatically rupturing the case due to a localized pressure; (2) moderately-violent type whose violence is similar to an electrically ignited round; and (3) severely-violent type whose violence is similar to a deflagration of high explosive. The deposited kinetic-energy was found to yield the best a priori prediction for both the type of reaction and the ranking within each type. It was hypothesized that the reaction can be characterized via 2 threshold-energy values E sub 1 and E sub 2, and 2 threshold-widths Delta E sub 1 and Delta E sub 2. Tests employing hypervelocity particles confirmed the threshold-energy hypothesis, with E sub 1 – approximately 10 kJ and E sub 2 - approximately 50 kJ for the 105-mm round. However, the hypervelocity particle and shaped charge jet data show that good a priori predictions can be made only if multiple off-axis impacts are accounted for. GRA

N79-20269# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF A WATER DELUGE SYSTEM TO EXTINGUISH M-1 PROPELLANT FIRES Final Report
J. W. Gehring, R. M. Rindner, and W. O. Seals Sep. 1978 93 p refs
(Contract DAAA21-76-C-0255)
(AD-A062086; AD-E400217; SwRI-02-4573; ARLCD-CR-78024) Avail: NTIS HC A05/MF A01 CSCL 13/12

In support of the U.S. Army Modernization Program, and the modernized 105-mm, M-67, bag loading and assembly operations, an effective water deluge system was designed and tested to extinguish a fire should it occur in either the bulk M-1 receiving hoppers, or the bagged M-1 accumulator conveyors. The feasibility of using a water deluge was first demonstrated, then a deluge system was designed which carefully considered the in-plant conditions when selecting an appropriate fast-response detector, a rapid-acting water valve, and the water pressure and water availability at the Indiana AAP. To evaluate the ability of a water deluge to extinguish M-1 propellant fires, full scale tests were conducted under the most stringent in-plant conditions. Plant construction and layout were simulated to evaluate effects of rising temperatures and pressures prior to fire extinguishment. Time response of the detectors and time to water application were monitored and recorded. Detailed designs of the unique deluge systems for both hopper and accumulator applications are given and are demonstrated to meet the two predominent requirements: (1) ability to extinguish the fire without severe building damage and fire propagation, and (2) a deluge system operating within the limits of water pressure and water volume available. Author (GRA)

N79-20270# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.
IGNITION, COMBUSTION, DETONATION, AND QUENCHING OF REACTIVE MIXTURES Final Report, 1 Apr. 1973 - 31 Mar. 1978
Rudolph Edse and Om P. Dhiman Jun. 1978 105 p refs
(Grant AF-AFOSR-2511-73)
(AD-A062291; AFOSR-78-1483TR) Avail: NTIS HC A06/MF A01 CSCL 07/4

A burner tube having a rectangular cross-section with a width-to-length ratio of approximately 200 has been used for measuring the quenching distances of various fuel oxidizer mixtures by squeezing the flames between two movable plates. For laminar flames the quenching distances were found to be independent of the initial gas speed, the Reynolds number of the flow of unburned gas, and the geometry of the burner port. However, they depend on the material and structure of the quenching surface; the composition of the unburned gas, its thermal conductivity, diffusion coefficient, and specific heats; the adiabatic flame/temperature, and the linear rate of flame propagation. Spectrographic studies revealed that quenching greatly reduces the concentrations of active species in the flame and that the populations of the rotational levels of the CH radical correspond to temperatures which are much higher than the adiabatic flame temperature. A simple mathematical model has been used to develop a theoretical equation for the prediction of quenching distances of various fuel-oxidizer mixtures. GRA

N79-20271# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CRITICAL ANALYSIS OF SOME COMMON ASSUMPTIONS IN COMBUSTION MODELS
John D. Powell Sep. 1978 46 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A062267; AD-E430135; ARBRL-TR-02107) Avail: NTIS HC A03/MF A01 CSCL 21/2

A brief, qualitative review of some of the basic assumptions used in macroscopic models of solid-propellant combustion is presented. The intent of the review is to discuss the limits of applicability of the assumptions and, thereby, to isolate problems in combustion theory requiring more microscopic analysis. Special consideration is given to such problems as heat conduction in the burning propellant, phase transitions at the surface, character-

ization of the nonequilibrium environment in the material, and the effects of that environment upon chemical-raction rates. Some relatively new theoretical techniques for analyzing the problems will be discussed, as well as some diagnostic techniques for experimental study and verification. Where possible, specific future investigations are recommended and possible benefits to combustion theory in general are explored. Author (GRA)

N79-20272# Naval Research Lab., Washington, D. C.
AGING BEHAVIOR OF CRUDE SHALE OIL Progress Report
Robert N. Hazlett, James M. Hall, and Jack C. Burnett Aug. 1978 11 p refs
(AD-A062420; AD-E000240; NRL-MR-3844) Avail: NTIS HC A02/MF A01 CSCL 11/8

Crude shale oil produced by the Paraho retort was heated for eight weeks at 50 C. This corresponds to at least one year of storage at ambient conditions. Increases in oil viscosity and in the content of hight molecular weight compounds were observed, but pour point changes were minimal. The overall changes at the experimental conditions used are modest. Author (GRA)

N79-20273# Naval Weapons Station, Yorktown, Va.
PREDICTING HIGH EXPLOSIVE DETONATION VELOCITIES FROM THEIR COMPOSITION AND STRUCTURE. 2: ADDENDUM
Lewis R. Rothstein and Robert Petersen Nov. 1978 14 p refs
(AD-A062265; NWSY-TR-78-4) Avail: NTIS HC A02/MF A01 CSCL 19/1

A previous technical report described a simple empirical relationship between detonation velocity at theoretical maximum density and a factor, F, that is dependent solely upon chemical composition and structure. The explosives ranged from nitro-aromatics, cyclic and linear nitramines, nitrate esters and nitro-nitrato aliphatics to zero hydrogen explosives, carbonless explosives and hydrogen rich explosives. Minor modifications have been made to the equations presented in that report, including a correction factor for liquid explosives, that have resulted in an improved predictive model in which: 95% of the predicted detonation velocities lie within 5% of experimental; the absolute error for 64 explosives is or - 2.3%; and the correlation coefficient for the linear regression relationship is greater than 0.96. Author (GRA)

N79-20274# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON CALCULATING IGNITION OF A PROPELLANT BED
Carl W. Nelson Sep. 1978 33 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A062266; AD-E430136; ARBRL-MR-02864) Avail: NTIS HC A03/MF A01 CSCL 21/2

Various criteria for ignition of solid propellants are considered for use in gun ballistics calculations. Experimental data are examined and extrapolated for use in the NOVA computer code. DeLuca's laser ignition data are considered most applicable. Calculated flamespreading rates with a surface temperature criterion agree better with measured rates than those calculated with ignition delay criteria from radiant flux experiments. Goodman's integral method is shown satisfactory for use in a linearly rising heat flux. Author (GRA)

N79-20275# Gough (Paul) Associates, Inc., Portsmouth, N.H.
THEORETICAL STUDY OF TWO-PHASE FLOW ASSOCIATED WITH GRANULAR BAG CHARGES
Paul S. Gough Sep. 1978 141 p refs
(Contract DAAK11-77-C-0028; DA Proj. 1L1-61102-AH-43)
(AD-A062144; AD-E430137; ARBRL-CR-00381) Avail: NTIS HC A07/MF A01 CSCL 19/4

The two phase flow code NOVA is used to study the effect of neglect of the geometric details of the charge configuration by making psuedo-1D approximations of radial ullage. An axially uniform radial 1D flow assumption calculation showed all flow variables except porosity to be radially uniform. A calculation permitting mass transfer around and through the bag predicts ignition in front as well as in the rear of the charge, thereby, reducing the pressure wave amplitudes. A third calculation simulated a break in the center core igniter and subsequent burn through of the bag material separating zone increments. The obstruction little affected computed ballistics. Annular ullage was found to persist contrary to 1D models which assume radial uniformity. GRA

N79-20276# Thiokol Corp., Huntsville, Ala.
STATISTICAL ANALYSIS OF STEADY STATE COMBUSTION OF COMPOSITE SOLID PROPELLANTS Final Report, 1 Jul. 1976 - 30 Sep. 1978
R. L. Glick Nov. 1978 64 p refs
(AD-A062591; U-78-15; AFOSR-78-1579TR) Avail: NTIS HC A04/MF A01 CSCL 21/9

A general method for extracting particle size dependent information from experimental rate/formulation data was developed from the statistical methodology. This technique was employed to correlate the data bases of Miller. Results showed that, by employing an interaction parameter of 4, both additive and additive free data could be correlated to standard error of estimate below 10.5%. The effect of steady radiant energy deposition on steady and nonsteady burning was explored. Results showed that if the radiant energy deposited in the reactive zones is negligible (an excellent assumption for low signature propellants) the effect of radiant energy deposition can always be accounted for by substituting the radiation augmented initial temperature for the initial propellant temperature. GRA

N79-20277# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
FUELS COMBUSTION RESEARCH Annual Report, 1 Oct. 1977 - 30 Sep. 1978
Frederick L. Dryer, I. Glassman, and Robert J. Santoro 1 Dec. 1978 63 p refs
(Contract F49620-78-C-0004; AF Proj. 2308)
(AD-A062538; MAE-1415; AFOSR-78-1632TR) Avail: NTIS HC A04/MF A01 CSCL 21/2

Interest in chemically related combustion problems has led to an integrated fuels, research program with emphasis on the pyrolysis and oxidation of aliphatic and aromatic hydrocarbons, soot formation/destruction and carbon oxidation. This document presents detailed results on the pyrolysis of ethene and propane, and reviews and analyzes aromatic oxidation mechanisms. Data on the high temperature oxidation of toluene were obtained on the Princeton flow reactor, and the oxidative rate characteristics were observed to differ markedly from the aliphatics. Experiments dealing with the formation and destruction of soot were undertaken from both fundamental and overall approaches. Experiments aimed at exploring the importance of OH radicals introduced by water addition were begun. Experiments were conducted to measure sooting height as an indication of sooting tendency. Soot height characteristics of several fuels and fuel mixtures were made, including mixtures of toluene and heptane. A second approach--involving premixing of fuel and soot inhibitors in a diffusion flame burner--has been considered, and initial experiments are currently underway. GRA

N79-20278# Southwest Research Inst., San Antonio, Tex.
DESIGN OF A WATER DELUGE TO EXTINGUISH M-1 PROPELLANT FIRES IN CLOSED CONVEYORS Final Report
J. William Gehring, Richard M. Rindner, and William O. Seals Sep. 1978 53 p refs
(Contract DAAA21-76-C-0255)
(AD-A062268; AD-E400216; ARLCD-CR-78023) Avail: NTIS HC A04/MF A01 CSCL 13/12

A water deluge system was designed to protect a vibrating conveyor line at Radford AAP which transports in-process propellant in various parts of the new Continuous Automated Single Base Line (CASBL). Full scale tests on a simulated conveyor line proved that a water deluge system can be effectively used to control propellant fires and to prevent the hazardous rise of pressure within the enclosed conveyor. An ultraviolet detector proved to be the most responsive type of fire sensor. The use of this system will eliminate the costly fire gates which had been proposed. Since the pressure rise in the closed conveyor can be limited to less than 55000 pa (approximately 8 psi), the proposed pressure vents can be eliminated. By using the more

responsive UV detectors, the redundant IR detectors can also be abandoned. Author (GRA)

N79-20279# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
DIRECT UTILIZATION OF CRUDE OIL AS FUEL IN THE US ARMY FOUR-CYCLE DIESEL ENGINE, MODEL LDT-465-1C Interim Report, Apr. 1977 - Aug. 1978
John V. Moffitt and Edwin A. Frame Aug. 1978 34 p refs (Contracts DAAG53-76-C-0003; DAAK70-78-C-0001)
(AD-A062387; AFLRL-108) Avail: NTIS HC A03/MF A01 CSCL 21/7

Performance curves for the U.S. Army LDT-465-1C engine were obtained using DF-2 and crude oils of varying properties. A cyclic endurance test was run using crude oil as the fuel. The results of the crude oil fueled test were compared to tests where DF-2 fuel was used. The crude oil resulted in significantly more engine wear and deposition than the DF-2. With crude oil fuel, the lubricant was severely degraded at end of test.
Author (GRA)

N79-20978# European Space Agency, Paris (France).
MODELS OF UNSTEADY COMBUSTION OF COMPOSITE SOLID PROPELLANTS
Paul Kuentzmann *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-2 (ESA-TT-496) Nov. 1978 p 49-77 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-2, Mar.-Apr. 1978 p 77-93 Original report in FRENCH previously announced as A78-38699 (For primary document see N79-20974 11-99)
Avail: NTIS HC A05/MF A01

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N79-20280*# AeroChem Research Labs., Inc., Princeton, N. J.
SYNTHESIS OF SILANE AND SILICON IN A NON-EQUILIBRIUM PLASMA JET Final Report
H. F. Calcote Oct. 1978 120 p refs Prepared for JPL
(Contract JPL-954560)
(NASA-CR-158374; AeroChem-TP-377;
DOE/JPL-954560-76/8) Avail: NTIS HC A06/MF A01 CSCL 13H

The original objective of this program was to determine the feasibility of high volume, low-cost production of high purity silane or solar cell grade silicon using a non equilibrium plasma jet. The emphasis was changed near the end of the program to determine the feasibility of preparing photovoltaic amorphous silicon films directly using this method. The non equilibrium plasma jet should be further evaluated as a technique for producing high efficiency photovoltaic amorphous silicon films. Author

N79-20281*# Siltec Corp., Menlo Park, Calif.
LSA LARGE AREA SILICON SHEET TASK CONTINUOUS LIQUID FEED CZOCHRALSKI GROWTH Quarterly Report, Oct. - Dec. 1978
George Fiegl Jan. 1979 28 p Sponsored by DOE
(Contract JPL-954886)
(NASA-CR-158366; DOE/JPL-954886-79/1; QR-5) Avail: NTIS HC A03/MF A01 CSCL 13H

A process for the continuous growth of crystals by the Czochralski method, suitable for producing single silicon crystals for use in solar cells was studied. Continuous growth is the growth of 100 Kg of single silicon crystals, 10 cm in diameter, from one container. A furnace with continuous liquid replenishment of the growth crucible, accomplished by a melt-down system and a liquid transfer mechanism, with associated automatic feedback controls was developed. Elements of the transfer system were further developed and tested during actual transfer runs. Considerable simplification of the heating element of the transfer tube was achieved. Accuracy and reliability of the temperature sensor, which is part of the power input control system for the transfer tube, was improved. Electrical and thermal effectiveness were increased while assembly of the transfer tube system was further simplified. Author

N79-20282*# Westinghouse Research and Development Center, Pittsburgh, Pa.
SILICON WEB PROCESS DEVELOPMENT Quarterly Report, 1 Oct. - 31 Dec. 1978
C. S. Duncan, R. G. Seidensticker, R. H. Hopkins, J. P. McHugh, F. E. Hill, M. E. Heimlich, and J. M. Driggers 1978 118 p refs Prepared for JPL
(Contract JPL-954654)
(NASA-CR-158376; ERDA/JPL-954654-79/1) Avail: NTIS HC A06/MF A01 CSCL 13H

Progress in the development of techniques to grow silicon web at 25 wq cm/min output rate is reported. Feasibility of web growth with simultaneous melt replenishment is discussed. Other factors covered include: (1) tests of aftertrimmers to improve web width; (2) evaluation of growth lid designs to raise speed and output rate; (3) tests of melt replensishment hardware; and (4) investigation of directed gas flow systems to control unwanted oxide deposition in the system and to improve convective cooling of the web. Compatibility with sufficient solar cell performance is emphasized. J.M.S.

N79-20283*# National Aeronautics and Space Administration. Pasadena Office, Calif.
LOW COST CRYOSTAT Patent Application
James B. Stephens, inventor (to NASA) (JPL) Filed 29 Mar. 1979 20 p
(Contract NAS7-100)
(NASA-Case-NPO-14513-1; US-Patent-Appl-SN-025162) Avail: NTIS HC A02/MF A01 CSCL 20L

An improved cryostat for use in a low or a substantially gravity-free environment adapted to cool an experiment through the use of helium II, or helium in its super fluid state is described. The cryostat is characterized by interchangeable daughter dewars and helium supply, and a mother dewar connected to a low pressure venting system for converting helium I to a super fluid state for use as a primary cryogen. Each daughter dewar is adapted to be removably mounted in mated relation on the mother dewar and has support for an experiment package, a source of helium to be employed as a secondary cryogen, and a heat pipe adapted to be extended into the mother dewar for facilitating cooling of the secondary cryogen. A transfer of heat from the package to the primary cryogen, (via the secondary cryogen) is accomodated as a film flow of helium II progresses from the heat pipe to the experiment dewar. NASA

N79-20284# California Univ., Los Angeles. Dept. of Physics.
RE-ENTRANT SUPERCONDUCTIVITY IN A MAGNETICALLY ORDERED SUPERCONDUCTOR La(1-x)Gd(x)Ru2
T. E. Jones, J. F. Kwak, E. P. Chock, and P. M. Chaikin 1978 8 p refs
(AD-A062382) Avail: NTIS HC A02/MF A01 CSCL 11/6

The critical temperature (Tc) and the upper critical magnetic field (Hc2) of La(1-x)Gd(x)Ru2 were measured. At low concentrations of the magnetic impurity (Gd), the suppression of Tc follows the expected Abrikosov-Gorkov (A-G) pair breaking curve. However, for larger concentrations, strong deviations below A-G are observed. Samples in this region (4. < or = x < or = 5. exhibit two Tc's. La(1-x)Gd(x)Ru2 is known to order magnetically, probably as a spin glass, and the magnetic ordering temperature (T sub M) has been measured in the normal state. This T sub M curve intersects the Tc curve in the concentration range where the Tc curve is re-entrant and we therefore attribute the re-entrant Tc behavior to the magnetic ordering of the Gd(3-) ions. Author (GRA)

N79-20285# California Univ., Berkeley. Univ. Extension.
EARTHQUAKE-RESISTANT REINFORCED CONCRETE BUILDING CONSTRUCTION. VOLUME 1: ORGANIZATION AND FINAL RECOMMENDATIONS
V. V. Bertero and S. A. Mahin Jun. 1978 121 p refs Workshop held at Berkeley, Calif., 11-15 Jul. 1977 3 Vol.
(Grant NSF ENV-76-01923)
(PB-288995/4; NSF/RA-780303) Avail: NTIS HC A06/MF A01 CSCL 13M

The state-of-the-art and state-of-the-practice in the design

and construction of seismic-resistant reinforced concrete buildings were assessed as well as current progress. Research needs and priorities for future work are discussed. GRA

N79-20286# California Univ., Berkeley. Univ. Extension.
EARTHQUAKE-RESISTANT REINFORCED CONCRETE BUILDING CONSTRUCTION. VOLUME 2: TECHNICAL PAPERS
V. V. Bertero and S. A. Mahin Jun. 1978 1004 p refs Workshop held at Berkeley, Calif., 11-15 Jul. 1977 3 Vol.
(Grant NSF ENV-76-01923)
(PB-288996/2; NSF/RA-780304) Avail: NTIS HC A99/MF A01

Topics discussed include: an overview of the state-of-the-practice in earthquake-resistant reinforced concrete building construction; user needs; mechanical characteristics and performance of reinforced and prestressed concrete materials under seismic conditions; reinforced and prestressed concrete structural systems; and methods of structural analysis. GRA

N79-20287# California Univ., Berkeley. Univ. Extension.
EARTHQUAKE-RESISTANT REINFORCED CONCRETE BUILDING CONSTRUCTION. VOLUME 3: TECHNICAL PAPERS
V. V. Bertero and S. A. Mahin Jul. 1978 923 p refs Workshop held at Berkeley, Calif., 11-15 Jul. 1977 3 Vol.
(Grant NSF ENV-76-01923)
(PB-288997/0; NSF/RA-780305) Avail: NTIS HC A99/MF A01 CSCL 13M

Topics discussed cover: design methods and experimental and analytical investigations related to the earthquake-resistant reinforced concrete building construction of moment-resisting frames and frame-wall structures; foundations and retaining structures; experimental investigations of real buildings, models of complete buildings and large subassemblages of buildings; and design methods and experimental and analytical investigations related to the earthquake-resistant reinforced concrete building construction of prestressed and prefabricated structures. GRA

N79-20288# Sydney Univ. (Australia). Civil Engineering Labs.
A METHOD OF ANALYSIS FOR HORIZONTALLY EMBEDDED ANCHORS IN AN ELASTIC SOIL
R. K. Rowe and J. R. Booker Feb. 1978 61 p refs
(PB-289521/7; R-316) Avail: NTIS HC A04/MF A01 CSCL 13B

A general method is presented for the analysis of horizontal anchors in an elastic soil. Provision is made in the analysis for the consideration of anchor shape, layer depth, anchor soil interface condition, breakaway of the anchor from the underlying soil and interaction between groups of anchors. Application of the analytical technique is illustrated for strip and circular anchors and these solutions are presented in the form of influence charts which may be used directly in hand calculations to predict the elastic load deflection behaviour of anchor plates for a wide variety of material and geometric conditions. GRA

N79-20289# National Bureau of Standards, Washington, D. C. Center for Building Technology.
THE SELECTION OF PREFERRED METRIC VALUES FOR DESIGN AND CONSTRUCTION Final Report
Hans J. Milton Dec. 1978 86 p refs Sponsored in part by the Naval Facilities Engineering Command, Va.
(PB-289781/7; NBS-TN-990) Avail: NTIS HC A05/MF A01 CSCL 13M

A comprehensive examination of considerations involved in the selection of preferred metric values during the change to SI in the U.S. construction community is presented. The adoption of preferred metric values and the concomitant rationalization of the technical data base will be one of the main benefits of the change to metric (SI) units. The principal aim is to encourage the choice of simple, convenient, or preferred metric values and ranges of rational values, rather than exact or marginally rounded soft conversions of existing values which will generally require a second change to more workable numbers at a later stage. GRA

N79-20290# California Univ., Los Angeles.
FORCED VIBRATION TESTING OF A REHABILITATED MULTISTORY BUILDING, VOLUME 1
Gary C. Hart, Sampson Huang, William T. Thompson, M. A. M. Torkamani, and Dixon Rhea Jun. 1978 82 p refs
(Grant NSF PFP-77-24062)
(PB-289904/5; UCLA-ENG-7822-Vol-1; NSF/RA-780309) Avail: NTIS HC A05/MF A01 CSCL 13M

A series of steady state harmonic forced vibration tests were conducted on a multi-story building before and after it was rehabilitated for seismic safety. The lateral resistance added to the building significantly increased the natural frequencies of vibration. Inplane floor slab deformations were significant in both tests. The deformation was greater in the pre-rehabilitation state. The North-South and the Torsion modes both indicated inslab floor deformations. Response was measured at 5,25 and 45 feet from the building on the surface of ground. The soil response was measureable and indicates that an analytical model of the system must be a soil/building model and interaction during an earthquake is probable. GRA

N79-20291# National Bureau of Standards, Washington, D. C. National Engineering Lab.
SOLAR BUILDING REGULATORY STUDY, VOLUME 2
Joe Greenberg Nov. 1978 385 p
(Contract EA-77-A-01-6010)
(PB-289824/5; NBS-GCR-78-141-2-Vol-2) Avail: NTIS HC A17/MF A01 CSCL 13A

The results of a project oriented toward obtaining the views of organizations representing diversified interests within the building community are documented regarding: (1) the need for a solar regulatory systems; and (2) the form such a system should take if indeed a solar regulatory systems were recommended. GRA

N79-20292# Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
DEVELOPMENT OF EMULSIFIED ASPHALT-AGGREGATE COLD MIX DESIGN PROCEDURE Final Report, 1976 - 1978
Michael I. Darter Feb. 1978 155 p refs Prepared in cooperation with Ill. State Dept. of Transportation, Springfield
(PB-289531/6; UILU-ENG-78-2006;
Transportation-Engr-Ser-22; FHWA-IL-78-UI-174) Avail: NTIS HC A08/MF A01 CSCL 13B

Extensive laboratory and field testing was conducted using the Marshall stability equipment and a capillary soak test. Aggregate and emulsion quality tests were performed to determined the compatibility of emulsion and aggregate (coating), optimum moisture content at mixing and at compaction, optimum residual asphalt content, and adequacy of structural and durability properties of the mixture. The mix design procedure is intended to be practical and easily implementable by governmental agencies and other. The procedure proved to be practical and reasonable. It is shown that emulsified asphalt-aggregate cold mixtures are complex, and good engineering design is essential to achieve consistently satisfactory results. GRA

N79-20293# Mississippi State Univ., State College. Dept. of Civil Engineering.
WAVE FORCES ON CAUSEWAY-TYPE COASTAL BRIDGES
Keith H. Denson Oct. 1978 54 p refs
(Contract DI-14-34-0001-8026)
(PB-289367/5; W79-01983; OWRT-A-118-MISS(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

A 1:24 scale model of the Bay St. Louis, Mississippi Bridge was used for the determination of lift and drag forces and rolling moment caused by normal incidence waves. The bridge was damaged by Hurricane Camille in 1969. The Bay St. Louis Bridge is a causeway-type, four-lane bridge of beam and slab construction. Pairs of lanes are structurally separated. Wave forces and moment were determined separately for the seaward and landward pairs of lanes. Design curves are presented in dimensionless form for scaling to prototype dimension. The study was made more applicable to other bridges of similar geometry by varying the height of the bridge deck above the bay bottom. Results predict observed anchorage failure in the Bay St. Louis Bridge. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N79-20294 George Washington Univ., Washington, D. C.
PATH INTEGRAL APPROACH TO FORWARD SCATTERING IN A RANDOM MEDIUM Ph.D. Thesis
Bruce Robert Hood 1978 130 p
Avail: Univ. Microfilms Order No. 7905541

The use of path integrals to study the problem of wave propagation in a continuous random medium is investigated. The problem is formulated by considering a time harmonic electromagnetic wave incident on a random half space with Gaussian statistics. The medium is assumed to have weakly fluctuating large scale inhomogeneities which leads to forward scattering when the wavelength of the source is much smaller than the scale of the inhomogeneities. Under these conditions and when backscatter is small the wave equation reduces to the parabolic equation. Using the Gaussian properties of the medium, exact expressions are written for the first, second and fourth moments of in path integral form. Dissert. Abstr.

N79-20295 British Broadcasting Corp., Kingswood (England). Engineering Div.
DIGITAL VIDEO: COMB FILTERING IN SUB-NYQUIST PAL CODECS
D. W. Osborne and J. H. Stott Jan. 1979 10 p refs
(BBC-RD-1979/1) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

It is possible in theory to reduce the slight impairment introduced by line-delay comb filters in a sub-Nyquist phase alternation link (PAL) codec by using alternative forms of comb filtering. The theoretical effects of line-delay, field-delay and picture-delay comb filters are described. Investigations of the effect of a field-delay filter compared with a line-delay filter in the decoder shows that although the expected changes are visible on special test pictures no significant differences are seen on typical (but critical) television pictures. However, further work is considered desirable to extend the investigation to both pre- and post sampling filters, including picture-delay filters, and to PAL signals for which cross-color has been reduced. A.R.H.

N79-20296* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYSTEM FOR SYNCHRONIZING SYNTHESIZERS OF COMMUNICATION SYSTEMS Patent
Edward A. Enriquez, inventors (to NASA) (Hughes Aircraft Co., Los Angeles) and Ronald E. Gookin (Hughes Aircraft Co., Los Angeles) Issued 20 Feb. 1979 18 p Filed 11 Apr. 1977 Supersedes N77-22314 (15 - 13, p 1707) Sponsored by NASA
(NASA-Case-GSC-12148-1; US-Patent-4,140,972; US-Patent-Appl-SN-786322; US-Patent-Class-325-58; US-Patent-Class-325-63; US-Patent-Class-343-179) Avail: US Patent and Trademark Office CSCL 17B

Frequency synthesizers at first and second stations that communicate with each other via a transmission link having a constant propagation delay time are started and synchronized by transmitting a tone from the first station to the second station via the link. The frequencies derived from the synthesizer at the second station are received at the first station and are combined with the frequencies derived from the synthesizer at the first station to derive a constant beat frequency as the two synthesizers are stepped.

Official Gazette of the U.S. Patent and Trademark Office

N79-20297* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INTERACTIVE COLOR DISPLAY FOR MULTISPECTRAL IMAGERY USING CORRELATION CLUSTERING Patent
Richard E. Haskell, inventor (to NASA) (Oakland Univ., Rochester, Mich.) Issued 13 Feb. 1979 12 p Filed 8 Sep. 1977 Supersedes N77-31583 (15 - 22, p 2957)
(NASA-Case-MSC-16253-1; US-Patent-4,139,862; US-Patent-Appl-SN-831631; US-Patent-Class-358-81; US-Patent-Class-358-109; US-Patent-Class-364-713) Avail: US Patent and Trademark Office CSCL 17B

A method for processing multispectral data is provided, which permits an operator to make parameter level changes during the processing of the data. The system is directed to production of a color classification map on a video display in which a given color represents a localized region in multispectral feature space. Interactive controls permit an operator to alter the size and change the location of these regions, permitting the classification of such region to be changed from a broad to a narrow classification.

Official Gazette of the U.S. Patent and Trademark Office

N79-20298*# Environmental Sensing Algorithm Development Co., Sunland, Calif.
EVALUATION AND ANALYSIS OF SEASAT A SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR) ANTENNA PATTERN CORRECTION (APC) ALGORITHM Final Report
S. N. Kitzis and J. L. Kitzis 16 Mar. 1979 84 p refs Prepared for JPL
(Contracts NAS7-100; JPL-955368)
(NASA-CR-158367) Avail: NTIS HC A05/MF A01 CSCL 20N

The accuracy of the SEASAT-A SMMR antenna pattern correction (APC) algorithm was assessed. Interim APC brightness temperature measurements for the SMMR 6.6 GHz channels are compared with surface truth derived sea surface temperatures. Plots and associated statistics are presented for SEASAT-A SMMR data acquired for the Gulf of Alaska experiment. The cross-track gradients observed in the 6.6 GHz brightness temperature data are discussed. Author

N79-20299*# RCA Government Systems Div., Moorestown, N. J. Missile and Surface Radar.
A STUDY OF LINEAR APPROXIMATION TECHNIQUES FOR SAR AZIMUTH PROCESSING Final Report
Lloyd W. Martinson, Richard P. Perry, and Bede Liu 1 Feb. 1979 178 p refs Prepared for JPL
(Contracts NAS7-100; JPL-955067)
(NASA-CR-158375) Avail: NTIS HC A09/MF A01 CSCL 17I

The application of the step transform subarray processing techniques to synthetic aperture radar (SAR) was studied. The subarray technique permits the application of efficient digital transform computational techniques such as the fast Fourier transform to be applied while offering an effective tool for range migration compensation. Range migration compensation is applied at the subarray level, and with the subarray size based on worst case range migration conditions, a minimum control system is achieved. A baseline processor was designed for a four-look SAR system covering approximately 4096 by 4096 SAR sample field every 2.5 seconds. Implementation of the baseline system was projected using advanced low power technologies. A 20 swath is implemented with approximately 1000 circuits having a power dissipation of from 70 to 195 watts. The baseline batch step transform processor is compared to a continuous strip processor, and variations of the baseline are developed for a wide range of SAR parameters. Author

N79-20300*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESULTS OF THIN-ROUTE SATELLITE COMMUNICATION SYSTEM ANALYSES INCLUDING ESTIMATED SERVICE COSTS
David L. Wright 1979 12 p ref Presented at the Intern. Telecommun. Exposition, Dallas, 26 Feb. - 2 Mar. 1979 Prepared in cooperation with Fairchild Space and Electronics Co., Germantown, Md.
(Contract NAS3-20364)
(NASA-TM-79098; E-9922) Avail: NTIS HC A02/MF A01 CSCL 17B

A variety of cost and performance tradeoffs are addressed and the preliminary design of a communications satellite system capable of meeting isolated rural users' needs is presented. Small inexpensive rural earth stations are linked via the satellite to a nation wide network of large earth stations which are, in turn,

interconnected to the switching exchanges of the conventional telephone network. Optimum earth station EIRP and G/T and satellite transponder power are defined as a function of a wide variety of system options. G.Y.

N79-20301*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ACCURACY ASPECTS OF STEREO SIDE-LOOKING RADAR
F. W. Leberl 1 Mar. 1979 59 p refs
(Contract NAS7-100)
(NASA-CR-158422; JPL-Pub-79-17) Avail: NTIS HC A04/MF A01 CSCL 17I

The geometry of the radar stereo model and factors affecting visual radar stereo perception are reviewed. Limits to the vertical exaggeration factor of stereo radar are defined. Radar stereo model accuracies are analyzed with respect to coordinate errors caused by errors of radar sensor position and of range, and with respect to errors of coordinate differences, i.e., cross-track distances and height differences. J.M.S.

N79-20302# Naval Research Lab., Washington, D. C. Electronic Warfare Support Measures Branch.
METEOR-BURST COMMUNICATION SYSTEMS: ANALYSIS AND SYNTHESIS Final Report
Anthony E. Spezio 28 Dec. 1978 42 p refs
(AD-A063159; NRL-8286) Avail: NTIS HC A03/MF A01 CSCL 17/2

Radio-wave propagation via scattering from ionized meteor trails was studied and employed as a means of communications for several decades. From the empirical and analytical data acquired, a propagation model to be used for communications link design can be extracted. This document derives and presents such a propagation model. Empirical data were obtained from the observation of meteor trail occurrences and intensities. The propagation model was developed as a function of the pertinent parameters by examining the transmission equation, the empirical data, and the geometric considerations. In this way, the characteristics of the meteor trail communication link were reduced to a manageable number of single and dual independent parameter equations and graphs that were suitable for system design and analysis. Examples were provided for utilizing the design equations in analyzing and synthesizing the meteor-burst communication link. Author (GRA)

N79-20303# Naval Ocean Systems Center, San Diego, Calif.
AIRBORNE FIBER OPTICS MANUFACTURING TECHNOLOGY. AIRCRAFT INSTALLATION PROCESSES Technical Report, May - Sep. 1978
G. Kosmos and R. A. Greenwell 24 Oct. 1978 123 p
(AD-A062683; NOSC/TR-340) Avail: NTIS HC A06/MF A01 CSCL 17/2

Manufacturing processes are being developed for installation of optical fiber harnesses and 'stand alone' links on military aircraft. Fabrication and installation plans and procedures are being developed and a routing analysis is being performed to provide a basis for installation of fiber optics in military aircraft. A life cycle cost analysis of the optical fiber harness indicates apparent economic advantages. Author (GRA)

N79-20304# Naval Ocean Systems Center, San Diego, Calif.
OCCURRENCE OF SCINTILLATION OF UHF SATCOM SIGNALS AT GUAM FROM MID-MARCH TO MID-AUGUST 1978 Final Report, 1 Oct. 1977 - 30 Sep. 1978
M. R. Paulson 7 Sep. 1978 21 p refs
(RR0320801)
(AD-A062943; NOSC/TR-328) Avail: NTIS HC A02/MF A01 CSCL 17/2

Occurrences of scintillation with fades greater than 6 dB are reported for the 257 MHz satellite signals recorded at Guam. These measurements cover the period from mid-March to mid-August 1978. The satellites were geostationary with about 10 and 50 degree elevation angles from Guam. The occurrence of scintillation is compared to the 2800 MHz solar flux. Reported satellite communications outages are also correlated with the occurrence of scintillation. Author (GRA)

N79-20305# Dialog Systems, Inc., Belmont, Mass.
INTELLIGENCE REPORT VOICE INPUT Final Technical Report
L. Bahler, P. Markey, and S. Moshier Griffiss AFB, N. Y. RADC Nov. 1978 90 p
(Contract F30602-76-C-0257; AF Proj. 4594)
(AD-A062845; RADC-TR-78-239) Avail: NTIS HC A05/MF A01 CSCL 17/2

This work was an initial effort in the use of voice data entry for information data handling. The objective of this effort was to develop the technology for a large vocabulary (1000 word) isolated word recognition system capable of quick adaptation and high accuracy for a limited number of people. Techniques for word boundary detection, noise suppression, and frequency scaling were examined. Tests were conducted on a 1000 word and a 100 word unstructured vocabulary. Recognition accuracies of 30.5% and 66% were obtained for the untrained case and 62.4% and 90% after training each word once. Author (GRA)

N79-20306# Hughes Aircraft Co., Fullerton, Calif.
NEAR FIELD ANTENNA MEASUREMENT SYSTEM Quarterly Progress Report, 1 Dec. 1977 - 28 Feb. 1978
A. E. Holley 8 Nov. 1978 20 p refs
(Contract DAAB07-77-C-0587)
(AD-A062295; FR-78-14-1293; QPR-2) Avail: NTIS HC A02/MF A01 CSCL 14/2

The report describes the second three months activity in the development of a fully self-contained automated near field antenna measurement facility. A description of the system is included. Author (GRA)

N79-20307# Southern Methodist Univ., Dallas, Tex. Dept. of Electrical Engineering.
ADAPTIVE DEMODULATION OF DIGITAL MODULATED SIGNALS Final Report, Jun. 1977 - Sep. 1978
M. D. Srinath 30 Nov. 1978 38 p refs
(Contract N00014-76-C-0456)
(AD-A062463; FR-1) Avail: NTIS HC A03/MF A01 CSCL 09/3

The estimation of the frequency spectrum of signals is of widespread importance in such diverse areas as seismic signal processing, vibration measurements, biomedical signal processing, speech transmission, etc. In communication systems, the estimation of the spectrum of a signal is of importance for both demodulation of angle modulated signals and in frequency synchronization. A commonly used technique for spectral estimation in stochastic signals is to identify the parameters of an autoregressive model of the signal and then determine the spectrum in terms of these parameters. Instead of identifying the autoregressive parameters, alternative parameters may be formulated which are preferable from an identification viewpoint. In this investigation, one such set of parameters is determined on the basis of sensitivity studies. The parameters are obtained from a nonlinear transformation of the autoregressive parameters. A maximum likelihood estimation scheme is used to obtain appropriate sequential algorithms for identification of these parameters. Several simulation examples are presented to illustrate the applicability of the algorithms for spectral estimation in a stationary stochastic process. GRA

N79-20308# AEL Service Corp., Farmingdale, N. J.
ELECTROMAGNETIC RADIATION SYSTEM (EMRS) FOR SUSCEPTIBILITY TESTING Quarterly Report, 1 Apr. - 30 Jun. 1978
Jack M. VanArsdale Nov. 1978 18 p
(Contract DAAB07-76-C-0332; DA Proj. 1L7-62701-AH-92)
(AD-A062388; AELSC-TR-23-2; CORADCOM-76-0332-7) Avail: NTIS HC A02/MF A01 CSCL 09/3

The function of the Electromagnetic Radiation System (EMRS) is to generate electromagnetic energy so as to produce a constant field strength that can be automatically scanned as a function of frequency. The design objective is to cover the frequency range of 30 hertz to 40 gigahertz with field strength intensities up to 200 volts per meter. The status of system hardware is described along with considerations of modulation circuitry, power leveling and control panel design. Author (GRA)

N79-20309# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE Progress Report, 1 Jan. - 22 Apr. 1978
Robert P. Pagliarulo, John P. Turtle, John E. Rasmussen, and

Wayne I. Klemetti Aug. 1978 79 p
(AD-A062534; RADC-TR-78-186) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplementary information.

Author (GRA)

N79-20310# Arinc Research Corp., Annapolis, Md.
AN/APS-96 RADAR MODIFICATION PROGRAM Progress Report, 1 Nov. 1977 - 31 Oct. 1978
W. Schulz Nov. 1978 27 p
(Contract N00019-77-C-0516)
(AD-A062569; Rept-1711-01-1-1830) Avail: NTIS HC A03/MF A01 CSCL 17/9

The Naval Avionics Center (NAC) at Indianapolis, Indiana, is producing the kit hardware for reliability, maintainability, and operational improvement modifications of the AN/APS-96 radars in service in E-2B aircraft. The series of modification kits, designed by ARINC Research Corporation, is being installed at NAS Miramar. This report, covering the period 1 November 1977 through 31 October 1978, summarizes the activities of ARINC Research engineers in supporting the refinement of the designs for kit production at NAC, the test and installation of kits at NAS Miramar, and the familiarization of the Navy technicians with the modified system. Author (GRA)

N79-20311# Boeing Co., Seattle, Wash.
ELECTROMAGNETIC COUPLING ANALYSIS OF A LEARJET AIRCRAFT Final Report, 15 Jun. 1977 - 15 Jun. 1978
D. F. Strawe, M. Obyrne, and S. Sandberg Sep. 1978 84 p refs
(Contract F33615-77-C-2058)
(AD-A062490; D180-24256-1; AFFDL-TR-78-121) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report presents the results of an electromagnetic modeling analysis of a Learjet aircraft. Coupling models were developed for the aircraft exterior and selected internal cabling. Calculations of pulse induced responses were made using the computer codes WIRANT and TRAFFIC. The calculated responses were compared to test data obtained by AFFDL. Lightning-induced responses were also calculated for a nearby 20 kiloampere stroke.

Author (GRA)

N79-20312# Radiation Research Associates, Inc., Fort Worth, Tex.
A LITERATURE REVIEW OF MILLIMETER AND SUBMILLIMETER RADIATION ABSORPTION AND SCATTERING IN THE ATMOSPHERE Final Report
D. M. Brown and M. B. Wells Oct. 1978 252 p refs
(Contract DAAK11-78-C-0016)
(AD-A062375; AD-E430139; RRA-T7804-1; ARBRL-CR-00382) Avail: NTIS HC A12/MF A01 CSCL 17/9

The presence on the electronic battlefield of smoke, dust, aerosols and exotic gases may seriously interfere with the effectiveness of battlefield radars in the millimeter and submillimeter wavelength range that have to operate in such an environment. This report describes a literature review that was performed on the absorption and scattering processes undergone by 100 micrometers to 1 cm wavelength radiation as it propagates through the atmosphere. Recommendations are given for further experimental and theoretical work that is needed to better define the absorption by atmospheric and battlefield generated gases and the scattering and absorption by atmospheric and battlefield generated aerosols and smokes. The Appendix contains a bibliography of the unclassified unlimited and limited distribution documents included in the literature review. The bibliography of the classified documents included in the literature review is given in Volume 2 of this report. Author (GRA)

N79-20313# State Univ. of New York at Buffalo. Dept. of Engineering Science, Aerospace Engineering and Nuclear Engineering.
SOME RESULTS ON THE ONE-DIMENSIONAL COUPLED NONLINEAR THERMOVISCOELASTIC WAVE PROPAGATION PROBLEM IN A SEMI-INFINITE ROD WITH FINITE THERMAL WAVE SPEED
C. Lee, W. P. Chang, and F. A. Cozzarelli Jul. 1978 50 p refs
(Contract N00014-75-C-0302)
(AD-A062253; Rept-104) Avail: NTIS HC A03/MF A01 CSCL 20/11

One-dimensional stress and temperature fields in a suddenly loaded and/or heated semi-infinite rod of nonlinear thermoviscoelastic material are studied using coupled thermomechanical theory. The transport of heat is governed by the modified Fourier heat conduction law, and thus proceeds by wave propagation rather than by diffusion. The application of thermal and mechanical disturbances at the end of the rod gives rise to two wave fronts along which these disturbances propagate. Field solutions for the stress and temperature are obtained by numerical integration along the five characteristics of the governing equations, and results are presented for several linear and nonlinear viscoelastic models. A closed form solution is also obtained via the Laplace transform for the special case of an uncoupled thermal wave.

Author (GRA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N79-20314* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROTARY ELECTRIC DEVICE Patent
Jesse M. Madey, inventor (to NASA) Issued 27 Feb. 1979 8 p Filed 21 Mar. 1977 Supersedes N77-20344 (15 - 11, p 1444)
(NASA-Case-GSC-12138-1; US-Patent-4,142,119; US-Patent-Appl-SN-779871; US-Patent-Class-310-46; US-Patent-Class-310-82; US-Patent-Class-310-231) Avail: US Patent and Trademark Office. CSCL 09C

An electric motor is described with a low speed shaft that rotates at a speed much slower than the speed of a high speed shaft. It is comprised of a stator having a cylindrical bore with a longitudinal axis and a rotor that carries the low speed shaft which rotates in the bore eccentrically about the axis. There is contact and no magnetic gap between a relatively small portion of the rotor periphery and the periphery of the bore. A magnetic field, rotating at the speed of the high speed shaft, is applied to the periphery of the bore. The field has longitudinally extending magnetic field components of opposite polarity so that around approximately 180 deg of the bore the field extends in one direction, while around the other 180 deg of the bore the field extends in the opposite direction. The rotor includes permanent magnet pole faces at opposite ends of the bore.

Official Gazette of the U.S. Patent and Trademark Office

N79-20315*# National Aeronautics and Space Administration. Pasadena Office, Calif.
CONTROLLER FOR COMPUTER CONTROL OF BRUSHLESS DC MOTORS Patent Application
Lester S. Hieda, inventor (to NASA) (JPL) Filed 23 Mar. 1979 23 p
(Contract NAS7-100)
(NASA-Case-NPO-13970-1; US-Patent-Appl-SN-023484) Avail: NTIS HC A02/MF A01 CSCL 09C

An improved motor speed and torque controller was invented for brushless DC motors which provides an unusually smooth torque control arrangement. The controller provides a means for controlling a current waveform in each winding of a brushless DC motor by synchronization of an excitation pulse train from a programmable oscillator. Sensing of torque for synchronization is provided by a light beam chopper mounted on the motor

rotor shaft. Speed and duty cycle are independently controlled by controlling the frequency and pulse width provided so that current oscillator. A means is also provided so that current transitions from one motor winding to another is effected without abrupt changes in output torque. NASA

N79-20316*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TWT DESIGN REQUIREMENTS FOR 30/20 GHz DIGITAL COMMUNICATIONS' SATELLITE
N. Stankiewicz and G. Anzic 1979 13 p Presented at the 17th Aerospace Sci. Meeting, New Orleans, 15-17 Jan. 1979; sponsored by AIAA
(NASA-TM-79119; E-9952) Avail: NTIS HC A02/MF A01 CSCL 09A

The rapid growth of communication traffic (voice, data, and video) requires the development of additional frequency bands before the 1990's. The frequencies currently in use for satellite communications at 6/4 GHz are crowded and demands for 14/12 GHz systems are increasing. Projections are that these bands will be filled to capacity by the late 1980's. The next higher frequency band allocated for satellite communications is at 30/20 GHz. For interrelated reasons of efficiency, power level, and system reliability criteria, a candidate for the downlink amplifier in a 30/20 GHz communications' satellite is a dual mode traveling wave tube (TWT) equipped with a highly efficient depressed collector. A summary is given of the analyses which determine the TWT design requirements. The overall efficiency of such a tube is then inferred from a parametric study and from experimental data on multistaged depressed collectors. The expected TWT efficiency at 4 dB below output saturation is 24 percent in the high mode and 22 percent in the low mode. L.S.

N79-20317*# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.
LIGHTWEIGHT MULTIPLE OUTPUT CONVERTER DEVELOPMENT
Jack J. Kisch and R. M. Martinelli Dec. 1978 75 p refs
(Contract NAS3-21045)
(NASA-CR-159526; P78-683R) Avail: NTIS HC A04/MF A01 CSCL 09C

A high frequency, multiple output power conditioner was developed and breadboarded using an eight-stage capacitor diode voltage multiplier to provide +1200 Vdc, and a three-stage for -350 Vdc. In addition, two rectifier bridges were capacitively coupled to the eight-stage multiplier to obtain 0.5 and 0.65 a dc constant current outputs referenced to +1200 Vdc. Total power was 120 watts, with an overall efficiency of 85 percent at the 80 kHz operating frequency. All outputs were regulated to three percent or better, with complete short circuit protection. The power conditioner component weight and efficiency were compared to the equivalent four outputs of the 10 kHz conditioner for the 8 cm ion engine. Weight reduction for the four outputs was 557 grams; extrapolated in the same ratio to all nine outputs, it would be 1100 to 1400 grams. Author

N79-20318# North Carolina Agricultural and Technical State Univ., Greensboro.
A STUDY OF TWO-DIMENSIONAL RECURSIVE DIGITAL FILTERS AND A STUDY OF IMPROVED STATISTICAL AND NON-DESTRUCTIVE TESTING METHODS OF FAILURE PREDICTION IN BRITTLE MATERIALS Final Report
10 Nov. 1978 122 p refs
(Contract N00014-77-C-0199)
(AD-A062315) Avail: NTIS HC A06/MF A01 CSCL 09/5

Research efforts covered by the subject contract have been directed toward the stability and synthesis problems for two dimensional digital recursive digital filters. Such filters are advantageous when a premium is placed upon computer storage, or computation time. Previously defined results on stability analysis have been refined and a revised paper has been submitted to the IEEE Transactions on Circuits and Systems for publication. This research effort will continue to address this complex problem. Approximately circularly symmetric lowpass, highpass, bandpass, bandstop, low frequency boost and high frequency boost filters have been designed. Evaluation of these filters with actual images of various types need to be addressed and has been proposed as a follow on to the effort described in this report. GRA

N79-20319# Boeing Aerospace Co., Seattle, Wash. Engineering Technology Div.
HYBRID TECHNOLOGY COST REDUCTION AND RELIABILITY IMPROVEMENT STUDY Final Report
H. M. Waldron, III and L. F. Buldhaupt Mar. 1978 154 p refs
(Contract N00163-77-C-0298)
(AD-A062247; D180-24054-1) Avail: NTIS HC A08/MF A01 CSCL 14/1

The objective of this multi-phase program is to develop the materials, processes, and controls to improve reliability and reduce cost of hybrid microelectronics for application in military avionic systems. The objective of the first phase, the study effort covered by this report, is to develop a data base for the subsequent phases. The first phase, performed over a 6-month period, consisted of two tasks: (1) collection of data and information and (2) data assessment and analysis. GRA

N79-20320# Naval Ocean Systems Center, San Diego, Calif.
INTERNATIONAL CONFERENCE ON THE APPLICATION OF CHARGE COUPLED DEVICES. PROCEEDINGS
1978 407 p refs Conf. held at San Diego, Calif., 25-27 Oct. 1978
(AD-A062663) Avail: NTIS HC A18/MF A01 CSCL 09/5

Contents: Visible Imaging Applications, IR Applications, Signal Processing Applications, and CCD Performance Characterization and Analysis. GRA

N79-20321# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
OPTIMAL DESIGN OF PLL WITH TWO SEPARATE PHASE DETECTORS
A. Heiman and Y. Bar-Ness Nov. 1978 34 p refs Prepared in cooperation with Tel-Aviv Univ., Israel
(Contract N00014-76-C-0279-P0002)
(AD-A062705) Avail: NTIS HC A03/MF A01 CSCL 09/3

In order to improve the operation of phase locked loops in both the acquisition and tracking modes, loops with two phase detectors are considered. The optimization problem of choosing the phase detectors in order to minimize the variance of loop phase error is formulated. The optimization problem is solved under several approximations. Despite the approximation, the resulting nonlinearities can be implemented and results in a PLL with improved performance in both acquisition and tracking. Author (GRA)

N79-20322# Naval Research Lab., Washington, D. C.
A UNIFIED THEORY OF 1/F NOISE
K. L. Ngai 11 Jan. 1979 35 p refs
(RR0110242)
(AD-A063118; NRL-MR-3917) Avail: NTIS HC A03/MF A01 CSCL 09/4

A theoretical model of mobility fluctuations that has a 1/f power spectra in electric current conducting materials and devices is presented. The theory traces the origin of the 1/f noise to some rather uncommon electronic or ionic energy structure and excitations which have been identified earlier to be responsible for the remarkable universal dielectric response behavior of condensed matter. The relation between the ubiquitous 1/f noise and the universal 1/omega to the (1-n) power low frequency dielectric response in current conducting material is pointed out and emphasized. We have thus a unified theory explaining on the same basis both physical phenomena with a single physical picture. Author (GRA)

N79-20323# Wentworth Inst., Boston, Mass.
ELECTRONIC SUPPORTING UNITS FOR SOUNDING ROCKET PAYLOADS
Robert W. Charron, Thomas J. Campbell, Thomas DiMilla, Jr., and Lawrence P. Smart 31 Mar. 1978 83 p refs
(Contract F19628-76-C-0211)
(AD-A062241; SR-2; AFGL-TR-78-0163) Avail: NTIS HC A05/MF A01 CSCL 09/3

Contents: Six-Switch Digital Timer, Spice Sensor Deployment,

Rocket-borne Vibration Recorder, C.D.S.F.U. Function Monitor Update. GRA

N79-20324# Varian Associates, Palo Alto, Calif.
PULSED GaAs IMPATT DIODE DEVELOPMENT Final Report, 1 Nov. 1976 - 31 Jul. 1977
T. L. Hierl, S. I. Long, J. Kinoshita, and B. R. Cairns Feb. 1978 97 p refs
(Contract N00123-76-C-1063)
(AD-A062496) Avail: NTIS HC A05/MF A01 CSCL 09/5

The research and development program entitled 'Pulsed GaAs IMPATT Diode Development' was sponsored by Naval Weapons Center, China Lake, California, to provide an improved high-power solid state pulsed source at a frequency of 14 GHz. These diodes are intended for use in injection-locked solid state transmitters using cavity-type power combiner circuits. The objective of this program was to design, fabricate and evaluate GaAs pulsed IMPATT diodes for generation of microwave energy in Ku-band. High efficiency devices were to be designed to operate at moderate duty cycles, short pulse lengths and to provide the maximum in peak output power. GRA

N79-20325# Naval Ocean Systems Center, San Diego, Calif.
ADAPTIVE FILTERING IN THE FREQUENCY DOMAIN USING THE COMPLEX LMS ALGORITHM Research and Development Report, Jun. 1977 - Mar. 1978
Mauro Dentino, John McCool, and Bernard Widrow 1 Apr. 1978 12 p refs
(AD-A062120; NOSC/TR-241) Avail: NTIS HC A02/MF A01 CSCL 09/3

Adaptive filtering in the frequency domain can be accomplished by Fourier transformation of the input signal and independent weighting of the contents of each frequency bin. The frequency-domain filter performs similarly to a conventional adaptive transversal filter but promises a significant reduction in computation when the number of weights equals or exceeds 16. Author (GRA)

N79-20326# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
HYBRID PACKAGING OF INTEGRATED CIRCUITS FOR ENGINE CONTROLS Final Report, Aug. 1974 - Jan. 1978
Howard B. Kast and James A. Loughran Jul. 1978 176 p refs
(Contract F33615-74-C-2070)
(AD-A062125; R78AEG453; AFAPL-TR-78-39) Avail: NTIS HC A09/MF A01 CSCL 09/5

This report documents the design, test, and development of an advanced electronic packaging candidate for future, on-engine electronic controls. Materials with low and well-matched expansion properties, special processes, and special joining alloys were used because of the large number of thermal cycles expected. Tape-automated bonding was used because it offers improved reliability and lower production cost. Included in the program were temperature cycling, thermal shock, vibration bench testing, and on-engine environmental testing. The results obtained were favorable. Author (GRA)

N79-20327# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
THERMAL CYCLING ANALYSIS OF THE THERMOPLASTIC MODULATOR Interim Report, Oct. 1977 - Mar. 1978
David L. Flannery Jul. 1978 48 p refs
(AD-A062133; AFAL-TR-78-102) Avail: NTIS HC A03/MF A01 CSCL 09/1

The problem of heat removal from the faceplate of a Thermoplastic Modulator for Coherent Optical Processing during rapid write-erase cycling was analyzed using two complementary theoretical approaches. Pertinent cases were treated and important results, having bearing on future designs, were obtained. Also, three likely candidates for substrate-to-ambient cooling were compared with the result that only one seems feasible. Author (GRA)

N79-20328# Watkins-Johnson Co., Palo Alto, Calif.
HIGH SPEED HIGH DYNAMIC RANGE A/D CONVERTER Final Technical Report, 1 Oct. 1977 - 4 Aug. 1978
S. K. Brierley Nov. 1978 45 p
(Contract F30602-77-C-0216)
(AD-A062536; WJ77-9141R2A; RADC-TR-78-237) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report describes the results of a program to evaluate the feasibility of the concept of an EBS A/D converter as outlined in U.S. Patent No. 4,034,363, 'Real Time Data Quantizer and Analog-to-Digital Converter System', assigned to the U.S. Air Force. John McNamara and Paul Van Etten of the Rome Air Development Center are the co-inventors. The design consisted of circularly scanned electron beam striking coded semiconductor target wedges. The program goal was to design and fabricate a breadboard EBS A/D converter using a single target wedge operating at a 200 MHz scan frequency and evaluate its technical feasibility. Major components of the EBS A/D converter are an electron gun, orthogonal deflection structures, semiconductor target, and output interface circuitry. A substantial portion of the program effort was devoted to the design and testing of a high impedance lumped element meanderline deflection system capable of generating the large beam displacements required in the target plane. Successful operation of these meanderlines was achieved. The unique semiconductor target sectors were designed and fabricated with good yield. Complete output circuitry was designed, built and tested satisfactorily. A complete A/D converter tube was built in which the diode response under actual operating conditions was successfully demonstrated. Funding and time constraints prevented the full demonstration of A/D conversion. However, all the major components of the tube and output interface circuitry were shown to operate as required. GRA

N79-20329# California Univ., Los Angeles. Dept. of Physics.
SELF-CONTAINED AUTOMATIC RECORDER OF THE DC JOSEPHSON CURRENT
R. W. Simon and P. Landmeier (Polytone Musical Instruments, Inc., N. Hollywood, Calif.) 30 May 1978 12 p refs
(AD-A062482) Avail: NTIS HC A02/MF A01 CSCL 09/5

A circuit for the automatic recording of the dc Josephson current as a function of magnetic field or other variable has been designed and constructed. The apparatus requires no additional signal processing devices as have techniques for this measurement utilized in the past. Sensitivity to critical current amplitudes corresponding to the appearance of five millivolts across a sensing resistor is attained as well as separate examination of the positive and negative halves of the zero-bias current. Author (GRA)

N79-20330# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
AN ANALYSIS OF CONTOURED CRYSTAL RESONATORS OPERATING IN OVERTONES OF COUPLED THICKNESS-SHEAR AND THICKNESS-TWIST
H. F. Tiersten and R. C. Smythe Nov. 1978 25 p refs
(Contract N00014-76-C-0368; Grant DAAG29-76-G-0176)
(AD-A062621; TR-26) Avail: NTIS HC A02/MF A01 CSCL 09/1

A previous treatment of overtone modes in trapped energy resonators is extended to the case of plates with slowly varying thickness. The resulting single scalar equation is applied in the analysis of plano-convex contoured quartz crystal resonators and a lumped parameter representation of the admittance, which is valid in the vicinity of a resonance, is obtained. The analysis holds for the fundamental and anharmonic overtones of the fundamental and each harmonic overtone thickness mode. The influence of piezoelectric stiffening, electrode mass loading and electrical shorting is included in the analysis. No adjustable parameters are required in the theory. Although the basic piezoelectric differential equation employed here is quite different from the ones that have been employed in similar applications heretofore, the analysis accounting for the contouring has appeared in the literature. It is shown that calculations based on the analysis agree extremely well with experimental results obtained with contoured AT-cut quartz crystal resonators. Author (GRA)

N79-20331# Radio Corp. of America, Somerville, N. J.
DEVELOPMENT REPORT FOR HIGH-RELIABILITY, LOW-COST INTEGRATED CIRCUITS Technical Report, 3 Nov.

1972 - 3 Sep. 1978
3 Sep. 1978 39 p
(Contract N00039-76-C-0240; XF54586002)
(AD-A062706) Avail: NTIS HC A03/MF A01 CSCL 09/5

Wafer fabrication has been completed. The control units (aluminum metallized DIC and DIP devices and trimetal devices in open DIC packages are 90-percent complete. Thermal-shock testing of HRLC(high-reliability, low-cost) product has defined a beam-tape design problem which has necessitated the redesign of the beam tapes on all types. Life-test matrices have been run on CD4012 and CA741 to gain a preliminary insight into the failure modes to be expected in Phase 3. GRA

N79-20332# Maryland Univ., Baltimore. Div. of Mathematics and Physics.
OPTIMAL FILTERS FOR NILPOTENT ASSOCIATE-ALGEBRAIC BILINEAR SYSTEMS
Shirish D. Chikte and James T. Lo Oct. 1978 14 p
(Grant AF-AFOSR-2671-74)
(AD-A062772; MPR-78-12; AFOSR-78-1544TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

We consider a bilinear signal process driven by a, Gauss-Markov process which is observed in additive, white, Gaussian noise. An exact stochastic differential equation for the least squares filter is derived when the signal process satisfies a nilpotency condition. It is shown that the filter is also bilinear and moreover that it satisfies an analogous nilpotency condition. Finally, an example is presented and ways of reducing filter dimensionality discussed. Author (GRA)

N79-20333# Canadian Commercial Corp., Ottawa (Ontario).
MANUFACTURING METHODS AND TECHNIQUES FOR MINIATURE HIGH VOLTAGE HYBRID MULTIPLIER MODULES Quarterly Progress Report, 1 Jul. - 30 Sep. 1978
B. Grant Gordon Oct. 1978 36 p
(Contract DAAB07-76-C-0041)
(AD-A063020; QPR-9) Avail: NTIS HC A03/MF A01 CSCL 09/5

The results of further life-testing of rectangular and curved multipliers is discussed. The commencement of the Confirmatory Sample phase is described including improvements in the manufacturing methods. Author (GRA)

N79-20012# Department of the Navy, Washington, D. C.
COST AND DESIGN ADVANTAGES DERIVED FROM THE STANDARD ELECTRONIC MODULES PROGRAM
David Gold, John M. Kucharski (EG and G Washington Analytical Services Center, Rockville, Md.), and Davis R. Bates (Raytheon Co., Sudbury, Mass.) *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 14 p (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N79-20334 Purdue Univ., Lafayette, Ind.
SOURCE-SINK FLOWS IN A RAPIDLY ROTATING ANNULUS Ph.D. Thesis
Albert Terrence Conlisk, Jr. 1978 246 p
Avail: Univ. Microfilms Order No. 7905710

The structure of the flow field induced by various source-sink geometries within a rapidly rotating annular region is examined. The flows which are examined are assumed axisymmetric and steady; solutions for the flow field within the centrifuge are calculated for the physical situation where the convective acceleration terms in the momentum equations and gravitational buoyancy effects are negligible. In addition to being of fundamental interest, the types of flows which are discussed have received much attention in recent years in connection with centrifuges; such machines are widely used in industry to separate binary mixtures. Dissert. Abstr.

N79-20335* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND TURBINE FOR EXTRACTING KINETIC ENERGY FROM A STREAM OF TWO-PHASE FLUID Patent
David G. Elliott, inventor (to NASA) (JPL) Issued 27 Feb. 1979 9 p Filed 31 Oct. 1977 Supersedes N78-11398 (16 - 02, p 0198) Sponsored by NASA
(NASA-Case-NPO-14130-1; US-Patent-4,141,219; US-Patent-Appl-SN-847278; US-Patent-Class-60-645; US-Patent-Class-60-649; US-Patent-Class-415-1; US-Patent-Class-415-143) Avail: US Patent and Trademark Office CSCL 20D

An axial flow separator turbine is described which includes a number of nozzles for delivering streams of a two-phase fluid along linear paths. A phase separator which responsively separates the vapor and liquid is characterized by concentrically related annuli supported for rotation within the paths. The separator has endless channels for confining the liquid under the influence of centrifugal forces. A vapor turbine fan extracts kinetic energy from the liquid. Angular momentum of both the liquid phase and the vapor phase of the fluid is converted to torque.
Official Gazette of the U.S. Patent and Trademark Office

N79-20336* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CLOSED LOOP SPRAY COOLING APPARATUS Patent
Donald L. Alger, William B. Schwab, and Edward R. Furman, inventors (to NASA) Issued 27 Feb. 1979 4 p Filed 31 Aug. 1977 Supersedes N77-32434 (15 - 23, p 3075) Division of US Patent Appl. SN-672220, filed 31 Mar. 1976, US-Patent-4,068,495
(NASA-Case-LEW-11981-2; US-Patent-4,141,224; US-Patent-Appl-SN-829315; US-Patent-Class-62-514R; US-Patent-Class-62-268; US-Patent-Class-62-376; US-Patent-Class-250-352; US-Patent-Class-313-22; US-Patent-Class-313-35; US-Patent-Appl-SN-672220; US-Patent-4,068,495) Avail: US Patent and Trademark Office CSCL 20D

A closed loop apparatus for jet spraying coolant against the back of a radiation target is described. The coolant is circulated through a closed loop with a bubble of inert gas being maintained around the spray. Mesh material is disposed between the bubble and the surface of the liquid coolant which is below the bubble at a predetermined level. In a second arrangement no inert gas is used, the bubble consists of vapor produced when the coolant is sprayed against the target.
Official Gazette of the U.S. Patent and Trademark Office

N79-20337*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME EFFECTS OF CYCLIC INDUCED DEFORMATION IN ROCKET THRUST CHAMBERS
N. P. Hannum and R. J. Quentmeyer 1979 15 p refs To be presented at the Conf. on Advanced Technol. for Future Space Systems, Hampton, Va., 8-11 May 1979; sponsored by AIAA
(NASA-TM-79112; E-9939) Avail: NTIS HC A02/MF A01 CSCL 20D

A test program to investigate the deformation process observed in the hot gas wall of rocket thrust chambers was conducted using three different liner materials. Five thrust chambers were cycled to failure using hydrogen and oxygen as propellants at a chamber pressure of 4.14 MN/m squre (600 psia). The deformation was observed nondestructively at midlife points and destructively after failure occurred. The cyclic life results are presented with an accompanying discussion about the types of failure encountered. Data indicating the deformation of the thrust chamber liner as cycles are accumulated are presented for each of the test thrust chambers. Author

N79-20338*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ON THE EQUIVALENCE BETWEEN SEMIEMPIRICAL FRACTURE ANALYSES AND R-CURVES

Thomas W. Orange 1979 34 p refs Presented at the 12th Natl. Symp. on Fracture Mech., St. Louis, 21-23 May 1978; sponsored by the Am. Soc. For Testing Water.
(NASA-TM-79127; E-9963) Avail: NTIS HC A03/MF A01 CSCL 20D

The relationship between several semiempirical fracture analyses (SEFA) and the R-curve concept of fracture mechanics is examined. The conditions for equivalence between a SEFA and an R-curve are derived. A hypothetical material is employed to study the relationship analytically. Equivalent R-curves are developed for real materials using data from the literature. For each SEFA there is an equivalent R-curve whose magnitude and shape are determined by the SEFA formulation and its empirical parameters. If the R-curve is indeed unique then the various empirical parameters cannot be constant, and vice versa. However, for one SEFA the differences are small enough that they may be within the range of normal data scatter for real materials. J.M.S.

N79-20339*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
METASTABLE SOUND SPEED IN GAS-LIQUID MIXTURES
Joseph W. Bursik (Rensselaer Polytechnic Institute) and Robert M. Hall Mar. 1979 54 p refs
(NASA-TM-78810) Avail: NTIS HC A04/MF A01 CSCL 20D

A new method of calculating speed of sound for two-phase flow is presented. The new equation assumes no phase change during the propagation of an acoustic disturbance and assumes that only the total entropy of the mixture remains constant during the process. The new equation predicts single-phase values for the speed of sound in the limit of all gas or all liquid and agrees with available two-phase, air-water sound speed data. Other expressions used in the two-phase flow literature for calculating two-phase, metastable sound speed are reviewed and discussed. Comparisons are made between the new expression and several of the previous expressions -- most notably a triply isentropic equation as used, a triply isentropic equation as used, among others, by Karplus and by Wallis. Appropriate differences are pointed out and a thermodynamic criterion is derived which must be satisfied in order for the triply isentropic expression to be thermodynamically consistent. This criterion is not satisfied for the cases examined, which included two-phase nitrogen, air-water, two-phase parahydrogen, and steam-water. Consequently, the new equation derived is found to be superior to the other equations reviewed. Author

N79-20340*# National Aeronautics and Space Administration, Washington, D. C.
THERMAL ANALYSIS OF TURBULENT FLOW OF A SUPERCRITICAL FLUID
Eitaro Yamane Mar. 1979 13 p refs Transl. into ENGLISH from Ann. Univ. Federal (Rio de Janeiro), v. B., 1976 p 423-434 Presented at COBEM 75: The 3d Brazilian Congr. on Mech. Eng., Rio de Janeiro, 9-11 Dec. 1975 Original language document was announced as A76-45147 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75406) Avail: NTIS HC A02/MF A01 CSCL 20D

The influence of the large variation of thermodynamics and transport properties near the pseudocritical temperature on the heat transfer coefficient of supercritical fluid in turbulent flow was studied. The formation of the characteristics peak in the heat transfer coefficient vs. bulk temperature curve is described, and the necessity of the fluid element at pseudocritical temperature located in the buffer layer is discussed. M.M.M.

N79-20341*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLOW FRICTION OF THE TURBULENT COOLANT FLOW IN CRYOGENIC POROUS CABLES
Robert C. Hendricks, V. M. Yeroshenko (Krzhizhanovsky Power Eng. Inst.), L. I. Zaichik (Krzhizhanovsky Power Eng. Inst.), and L. S. Yanovsky (Krzhizhanovsky Power Eng. Inst.) 1979 18 p refs Proposed for presentation at the 15th Intern. Congr. on Refrigeration, Venice, 23-29 Sep. 1979; sponsored by Intern. Inst. of Refrigeration Prepared for DOE
(NASA-TM-79052; DOE/NASA/0207-79/1) Avail: NTIS HC A02/MF A01 CSCL 20D

Considered are cryogenic power transmission cables with porous cores. Calculations of the turbulent coolant flow with injection or suction through the porous wall are presented within the framework of a two-layer model. Universal velocity profiles were obtained for the viscous sublayer and flow core. Integrating the velocity profile, the law of flow friction in the pipe with injection has been derived for the case when there is a tangential injection velocity component. The effect of tangential velocity on the relative law of flow friction is analyzed. The applicability of the Prandtl model to the problem under study is discussed. It is shown that the error due to the acceptance of the model increases with the injection parameter and at lower Reynolds numbers; under these circumstances, the influence of convective terms in the turbulent energy equation on the mechanism of turbulent transport should be taken into account. Author

N79-20342*# Michigan State Univ., East Lansing. Dept. of Mechanical Engineering.
MEASUREMENTS IN A LARGE ANGLE OBLIQUE JET IMPINGEMENT FLOW
John F. Foss 7 Aug. 1978 48 p Submitted for publication (Grant NGR-23-004-091)
(NASA-CR-158385) Avail: NTIS HC A03/MF A01 CSCL 20D

The flow field associated with the oblique impingement of an axisymmetric jet was investigated in the externally blown flap configuration for the STOL aircraft. The passive and active spreading characteristics of the shallow angle (a greater than or = approximately to 15 degrees) oblique impingement flow, the role of the initially azimuthal vorticity field, and the stagnation point region were studied, and compared to the large (a = 45 degrees) oblique jet impingement flow. A description of the characteristics of the large angle impingement flow is presented: A flow field near the plate as showing two distinct patterns, one near the location of the maximum surface pressure, and another about the geometric intersection of the jet axis with the plate; and turbulence in the region above the plate which is greater than the one accounted for by the convection of turbulence energy by the mean motion. M.M.M.

N79-20343*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPACE SHUTTLE ORBITER TRIMMED CENTER-OF-GRAVITY EXTENSION STUDY. VOLUME 3: IMPACT OF RETROFITS FOR CENTER-OF-GRAVITY EXTENSION ON ORBITER THERMAL-PROTECTION SYSTEM Interim Technical Information Releases
James C. Dunavant Feb. 1979 39 p refs
(NASA-TM-72661) Avail: NTIS HC A03/MF A01 CSCL 22B

Heat transfer studies were conducted at Mach 10.3 on space shuttle orbiter models with the S-2 fillet and C-4 canard retrofit moldlines which were generated in aerodynamic and system design studies to increase the allowable c.g. range of the oribiter. Areas of orbiter most strongly affected were the sides where a shear layer which separated along the wing leading edge impinged. Analytical studies of the heating effect on the thermal-protection system were made which indicated that scar weight on the orbiter sides due to allowances for retrofits of the S-2 fillet and C-4 canard is small (less than about 90 kg (200 lbs) in comparison to the total weight of the retrofit). Author

N79-20344*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRESSURE AND THERMAL DISTRIBUTIONS ON WINGS AND ADJACENT SURFACES INDUCED BY ELEVON DEFLECTIONS AT MACH 6
Louis G. Kaufman, II (Grumman Aerospace Corp., Bethpage, N. Y.) and Charles B. Johnson Mar. 1979 59 p refs
(NASA-TP-1356; L-12636) Avail: NTIS HC A04/MF A01 CSCL 01A

Surface pressure distributions and heat transfer distributions were obtained on wing half-models in regions where three dimensional separated flow effects are prominent. Unswept and 50 deg and 70 deg swept semispan wings were tested, for trailing-edge-elevon ramp angles of 0 deg, 10 deg, 20 deg, and 30 deg, with and without cylindrical and flat plate center bodies and with and without various wing-tip plates and fins. The data, obtained for a free stream Mach number of 6 and a wing-root-

chord Reynolds number of 18.5 million, reveal considerably larger regions of increased pressure and thermal loads than would be anticipated using non-separated flow analyses. Author

N79-20345*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

MEASURED AND PREDICTED SHOCK SHAPES AND AERODYNAMIC COEFFICIENTS FOR BLUNTED CONES AT INCIDENCE IN HELIUM AT MACH 20.3

Robert L. Calloway and Nancy H. White Mar. 1979 74 p refs

(NASA-TP-1395; L-12058) Avail: NTIS HC A04/MF A01 CSCL 01A

Experimental values of shock shapes (alpha = 0 degrees and 10 degrees) and static aerodynamic coefficients (alpha = -4 degrees to 12 degrees) for sharp and spherically blunted cones having cone half-angles of 30, 45, 60, and 70 degrees and nose bluntness ratios of 0, 0.25, and 0.50 are presented. Shock shapes were also measured at 0 degree angle of attack by using a flat-faced cylinder (90 degree cone) and a hemispherically blunted cylinder (sphere). All tests were conducted in helium (gamma = 5/3) at a free-stream Mach number of 20.3 and a unit free-stream Reynolds number of 22,400,000 per meter. Comparisons between measured values and predicted values were made by using several numerical and simple engineering methods. M.M.M.

N79-20346*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FUNDAMENTAL MECHANISMS THAT INFLUENCE THE ESTIMATE OF HEAT TRANSFER TO GAS TURBINE BLADES

R. W. Graham 1979 13 p refs To be presented at the Natl. Heat Transfer Conf., San Diego, Calif., 5-8 Aug. 1979; cosponsored by ASME and the Am. Inst. of Chem. Engr.

(NASA-TM-79128; E-9966) Avail: NTIS HC A02/MF A01 CSCL 21E

Estimates of the heat transfer from the gas to stationary (vanes) or rotating blades poses a major uncertainty due to the complexity of the heat transfer processes. The gas flow through these blade rows is three dimensional with complex secondary viscous flow patterns that interact with the endwalls and blade surfaces. In addition, upstream disturbances, stagnation flow, curvature effects, and flow acceleration complicate the thermal transport mechanisms in the boundary layers. Some of these fundamental heat transfer effects are discussed. The chief purpose of the discussion is to acquaint those in the heat transfer community, not directly involved in gas turbines, of the seriousness of the problem and to recommend some basic research that would improve the capability for predicting gas-side heat transfer on turbine blades and vanes. L.S.

N79-20347# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.

NORMAL SHOCK INTERACTION WITH A TURBULENT BOUNDARY LAYER ON A CURVED WALL

G. R. Inger and H. Sobieczky Oct. 1978 44 p refs

(Contract N00014-75-C-0456)

(AD-A062353; VPI-AERO-088) Avail: NTIS HC A03/MF A01 CSCL 20/4

A detailed analysis is made of longitudinal surface curvature effects on the interaction of a weak normal shock with a non-separating two-dimensional turbulent boundary layer. It is shown that the interactive viscous displacement effect on the local outer inviscid transonic flow completely eliminates the well-known singularity pertaining to purely inviscid flow on a curved wall, i.e., the interactive pressure field is regular behind the shock. A study of the inner interaction solution within the boundary layer, however, reveals that curvature can influence the interaction but for a hitherto-overlooked reason: the effect on the turbulent eddy viscosity, which alters the boundary layer profile shape upon which the interaction depends. An approximate nonasymptotic solution is given which incorporates this effect and example numerical results are presented and verified by comparison with experimental data. Small amounts of curvature are found to moderately spread out and thicken the interaction zone while also beneficially delaying the onset of any incipient separation that occurs under the shock foot. GRA

N79-20348# Honeywell, Inc., Minneapolis, Minn. Avionics Div.

ADVANCED FLUIDIC TEMPERATURE STUDIES Final Report, 1 Aug. 1977 - 31 Mar. 1978

Walter M. Posingies Oct. 1978 80 p refs

(Contract DAAJ02-77-C-0036; DA Proj. 1L2-63211-D-157)

(AD-A063147; Honeywell-WO454FR1; USARTL-TR-78-33)

Avail: NTIS HC A05/MF A01 CSCL 13/7

A Hydrofluidic Stability Augmentation System (HYSAS) developed in a previous program was modified to extend its operating temperature range. Baseline performance data, parametric test data, and a detailed analysis of the selected compensation approaches are presented. The compensated system was tested with MIL-H-5606 oil, and its gain remained within a + or - 20-percent band over the temperature range from 50 to 180 F. Author (GRA)

N79-20349# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

UNSTEADY BOUNDARY LAYER FLOW REVERSAL IN A LONGITUDINALLY OSCILLATING FLOW Ph.D. Thesis - Colorado Univ.

John Powers Retelle, Jr. 1978 151 p refs

(AD-A063140; AFIT-CI-79-46D) Avail: NTIS HC A08/MF A01 CSCL 20/4

Measurements of boundary layer flow reversal made in a wind tunnel on a stationary NACA 0012 airfoil immersed in a longitudinally oscillating subsonic flow are described. A split-film sensor provided flow reversal data in regions above the airfoil surface throughout the period of flow oscillation. At angles of attack below the steady-flow stall angle of attack and for small amplitude oscillations, regions of boundary layer flow reversal near the leading edge were observed to vary nominally in phase with the time-varying external velocity. However, an increase in the oscillation amplitude produced a phase lead and an increased down-stream extent of the flow reversal region. Variations in the oscillation frequency produced only small changes in the shape of the flow reversal region. For angles of attack greater than the steady-flow stall angle, the growth and decay of reversed flow regions were observed to be stronger functions of the velocity oscillation frequency and amplitude. Increases in oscillation amplitude produced larger reversal regions which nominally lagged the phase of the free stream velocity. It is shown that boundary layer flow reversal on a stationary airfoil in an oscillating free stream responds to changes in the flow unsteadiness in a manner similar to the flow reversal observed during the onset of dynamic stall on an airfoil oscillating in pitch. GRA

N79-20350# California Univ., Berkeley. Dept. of Chemical Engineering.

A KINETIC NETWORK MODEL FOR NONLINEAR VISCOELASTIC FLOW PROPERTIES OF ENTANGLED MONODISPERSE POLYMERS

David Soong and Mitchell Shen Nov. 1978 12 p refs

(Contract N00014-75-C-0955)

(AD-A062661; TR-21) Avail: NTIS HC A02/MF A01 CSCL 20/4

In this work, we shall propose a kinetic network model which appears to predict the observed nonlinear viscoelastic flow properties of entangled polymer systems. The basic molecular mechanism of this model attributes the rate-dependence of viscosity and normal stress difference to the decrease in entanglement density with increasing shear rate. In a flow field, entanglements are being formed and disengaged constantly. The entanglement loss process is caused primarily by the imposed shear and is assumed to be proportional to the shear rate to a power a; where a(-1) accounts for the elastic nature of the polymer. The entanglement creation process, driven by thermal diffusion, is assumed to be independent of shear rate. GRA

N79-20351# ARO, Inc., Arnold Air Force Station, Tenn.

INTEGRAL SOLUTION OF COMPRESSIBLE TURBULENT BOUNDARY LAYERS USING IMPROVED VELOCITY PROFILES Final Report, Mar. - Nov. 1977

David L. Whitfield AEDC Dec. 1978 50 p refs

(AD-A062946; AEDC-TR-78-42) Avail: NTIS HC A03/MF A01 CSCL 20/4

A shear-work integral method is developed for calculating

compressible turbulent boundary layers on planar or axisymmetric bodies. This method differs from other integral techniques primarily in the velocity profile and the velocity-temperature relation used. The velocity profile is an analytical expression that depends on the local values of skin friction, shape factor, and Reynolds number based on momentum thickness, thus no new parameters not already occurring in the integral equations are introduced. The velocity-temperature relation is also an analytical expression that describes the total-temperature overshoot near the outer edge of turbulent adiabatic wall boundary layers with nonunity Prandtl number and recovery factor. The method is fast, easy to use, and shown to provide good agreement with experimental data. The resulting computer code is relatively small. A computer program listing that is applicable to the calculation of impermeable, adiabatic wall, turbulent boundary layers for Mach numbers up to three is included. Author (GRA)

N79-20352# Naval Postgraduate School, Monterey, Calif.
TIME DEPENDENT STUDIES OF REACTIVE SHOCKS IN THE GAS PHASE
E. S. Oran, T. R. Young, and J. P. Boris 16 Nov. 1978 42 p refs
(RR0240241)
(AD-A062258; NRL-MR-3889) Avail: NTIS HC A03/MF A01 CSCL 21/2

The coupling of the hydrodynamics and the chemical kinetics in a reactive mixture ignited by the passage of a shock is examined using a time-dependent numerical model. The fluid dynamic and chemical rate equations are integrated self-consistently on their own characteristic time-scale using the flux-corrected transport and selected asymptotic methods, respectively. Results are presented for a shock in an H2-O2 mixture. The detailed calculations of the chemical and fluid structure of the shocked region show clearly how the chemical energy released is partitioned between the fluid motion and the internal energy. A calculation is also shown for a reactive shock reflected from a rigid wall. Author (GRA)

N79-20353# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL COMPARISON OF ENHANCED HEAT TRANSFER CONDENSER TUBING M.S. Thesis
James Henry Fenner Sep. 1978 179 p refs
(AD-A062204; NPS69-78-015) Avail: NTIS HC A09/MF A01 CSCL 13/11

Ten 15.9 mm (5/8 in.) nominal outside diameter geometrically enhanced tubes of different metals were tested to determine their heat transfer and hydrodynamic performance. Results were compared to smooth copper-nickel tubes. Steam at about 21 Pa (3 psia) was condensed on the outside surface of each enhanced tube, horizontally mounted in the center of a dummy tube bank. Each tube was cooled on the inside by water at velocities of 2.7 to 7.6 m/sec (3 to 25 ft/sec). The overall heat transfer coefficient was determined from experimental data. The inside heat transfer coefficients were determined using the Wilson plot technique. Friction factor in the enhanced section was determined from the cooling water pressure drop. Enhanced geometries (utilizing pitch, helix angle and groove depth) were found to improve the corrected overall heat transfer coefficient by as much as 2 times that for smooth tubes. Use of enhanced tubes in place of smooth tubes will permit a decrease in condenser tube surface area from 17 to 53 percent for constant heat loads and constant pumping power. Author (GRA)

N79-20354# Naval Postgraduate School, Monterey, Calif.
HOT FLOW TESTING OF MULTIPLE NOZZLE EXHAUST EDUCTOR SYSTEMS M.S. Thesis
Daniel R. Welch Sep. 1978 131 p refs
(AD-A062205) Avail: NTIS HC A07/MF A01 CSCL 20/4

Hot flow model tests of multiple nozzle exhaust eductor systems were conducted to evaluate effects of exhaust temperature on eductor performance. A one-dimensional analysis of a simple eductor system based on conservation of momentum for an incompressible gas was used in determining the non-dimensional parameters governing the flow phenomenon. Eductor performance is defined in terms of these parameters. An experimental correlation of these parameters which was previously developed and used to correlate cold flow data was found to be effective in correlating both cold and hot flow data for eductor systems. Temperature data was obtained for the mixing stack wall and the exhaust flow at the mixing stack exit plane. Author (GRA)

N79-20355# Mississippi Univ., University. Dept. of Mechanical Engineering.
FINITE ELEMENT MODELING OF TWO-DIMENSIONAL CASCADE FLOWS Final Report, 1 May 1976 - 31 Aug. 1978
Shu-Yi Wang 30 Oct. 1978 115 p refs
(Grant AF-AFOSR-2982-76; AF Proj. 2307)
(AD-A062395; SW-78-1; AFOSR-78-1492TR) Avail: NTIS HC A06/MF A01 CSCL 20/4

This study develops a new numerical solution technique to simulate the transonic cascade flow through turbomachines, and also improves the understanding of the basic characteristics of turbomachine flows through a systematic process of improvements to increase the level of model sophistication. The Finite Element Method (FEM) is especially suitable for solving problems with irregular boundary geometry including curved as well as sharp-cornered ones, because the shape and size of each element may be specified arbitrarily and sides of each element may be curved. Therefore, the complication of governing differential equations needed, which through coordinated transformations yield a rectangular computation domain in finite difference schemes, can be avoided, and the accuracy as well as computing efficiency may be improved by adjusting the size and shape of the elements. Author (GRA)

N79-20356# Purdue Univ., Lafayette, Ind.
THE GROWTH OF THE TWO DIMENSIONAL MIXING LAYER FROM A TURBULENT AND NONTURBULENT BOUNDARY LAYER
F. K. Browand and B. O. Latigo Nov. 1978 39 p refs
(Contract N00014-75-1143; Proj. SQUID)
(AD-A062092; SQUID-USC-1-PU) Avail: NTIS HC A03/MF A01 CSCL 20/4

The effect of the initial boundary layer upon the downstream growth of the turbulent mixing layer between two streams is studied experimentally. Two streams are studied experimentally. Two conditions are carefully documented--in one case the boundary layers at separation are laminar; in the other case one boundary layer is made turbulent with a trip wire. When the boundary layer is turbulent, the lateral length scale, theta, characterizing the thickness of the mixing region, grows more slowly. At 400-500 initial momentum thicknesses downstream, the growth rate relaxes toward--but does not meet--the growth rate of the untripped mixing layer. The lateral distributions of turbulence quantities, when scaled with the local lateral thickness, achieve the same form at distances beyond approximately 800 momentum thicknesses. Author (GRA)

N79-20357# Dynamics Technology, Inc., Torrance, Calif.
NUMERICAL ASSESSMENT OF THE COMPUTER CODES FOR ANALYZING BOUNDARY LAYER TRANSITION ON A HEATED AXISYMMETRIC BODY
Kent T. S. Tzou Nov. 1978 71 p refs
(Contract N00014-77-C-0005; NR Proj. 062-565)
(AD-A062887; DT-7802-6) Avail: NTIS HC A04/MF A01 CSCL 20/4

An assessment of the available analytical tools for analyzing boundary-layer transition on a heated axisymmetric body has been performed. The approach is focused on the evaluation of the validity and efficiency of the three major components in the TAPS Cods, Axisymmetric Potential Flow, Boundary Layer Flow, and Linear Stability Analysis. In addition, further developments of the TAPS Code, the incorporation of roughness model is also presented. Several conclusions on the code comparison have been made. For axisymmetric potential flow, the numerical approach of Landweber for solving the Fredholm integral equation of the first kind is relatively simple and less time consuming when compared with the approach of Hess and Smith for solving the Fredholm integral equation of the second kind. For bodies with sudden changes in slope and curvature, or with local bumps, the approach of Hess and Smith can provide a better approximation than Landweber's for potential flow calculations. For boundary-layer flow calculation, a new code developed by Cebeci appears to have merit for improving computational efficiency. The key

factor is attributed to the fact that it solves the momentum and energy equations simultaneously. For the purpose of spatial amplification analysis, the stability component of the TAPS Code is less expensive than the code developed by Lowell and Reshotko. Since the validity of partial non-parallel flow effect in the TAPS Code is questionable and the computer code to account for the effect of full non-parallel flow with heat transfer is not available at present, the parallel flow option in the TAPS Code is recommended. GRA

N79-20358# Rockwell International Corp., Columbus, Ohio. Aircraft Div.
LIGHTWEIGHT HYDRAULIC SYSTEM EXTENDED ENDURANCE TEST Final Report, 24 Dec. 1977 - 21 Sep. 1978
Joseph N. Demarchi and Robert K. Haning Sep. 1978 43 p refs
(Contract N62269-78-C-0005)
(AD-A062749; NR78H-92; NADC-77218-30) Avail: NTIS HC A03/MF A01 CSCL 13/7

A 100 hour endurance test completed in a prior project was extended to 200 hours. The evaluation was conducted at 8000 psi and -200 F on hydraulic components in a laboratory system designed to be representative of aircraft-type circuitry. The hardware cycled were: pump, relief valve, restrictors, solenoid valves, flow control valve, seals (22), hydraulic fluid (MIL-H-83282), tubing, fittings, and hoses. The test was completed satisfactorily. GRA

N79-20981# European Space Agency, Paris (France).
TURBULENCE STATISTICS IN A GAS WITH BROADLY VARYING ENTROPY
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-3 (ESA-TT-522) Dec. 1979 p 1-15 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 99-103 Original report in FRENCH previously announced as A78-47344 (For primary document see N79-20980 11-99)
Avail: NTIS HC A06/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N79-20359# Sydney Univ. (Australia). Dept. of Aeronautical Engineering.
A CONSTANT TEMPERATURE HOT-WIRE ANEMOMETER
L. Stellema May 1978 31 p refs
(ATN-7803) Avail: NTIS HC A03/MF A01

A constant-temperature hot-wire anemometer that measures average and turbulent wind velocities is described. Its main features are good accuracy and ease of calibration and operation. J.M.S.

N79-20360# Naval Research Lab., Washington, D. C.
A NONLINEAR FILTERING TECHIQUE FOR DIGITIZED IMAGES DEGRADED BY FILM-GRAIN NOISE
Warren W. William 30 Aug. 1978 38 p refs
(RR0140241)
(AD-A063134; NRL-8225) Avail: NTIS HC A03/MF A01 CSCL 14/5

A class of nonlinear recursive filtering and smoothing algorithms is investigated for use in digital processing of images degraded by film-grain noise. These algorithms are developed by using a Bayesian perturbation analysis and a class of 'almost Gaussian' conditional probability distributions to obtain results that are formally accurate to first order in the perturbation parameters. The nonlinear features of the resulting algorithms are used to account for the signal dependence of film-grain noise and the nonlinear relation between optical density and intensity. These algorithms are tested on a photographic film negative. Some improvement over conventional Wiener filtering is found. Author (GRA)

N79-20361# Stanford Univ., Calif. Electronics Labs.
INSTRUCTION MANUAL FOR THE AUDIO-FREQUENCY TRACKING FILTER
Evans W. Paschal Sep. 1978 143 p
(Contract N00014-75-C-0601; Grants NSF DPP-74-0409-3; NSF DPP-76-82646)
(AD-A062687; SU-TR-3477-2; SU-SEL-78-030) Avail: NTIS HC A07/MF A01 CSCL 14/2

An audio-frequency tracking voltmeter developed for measuring the amplitudes of individual components of complex signals is described. It is intended as a guide to the use and maintenance of the instrument and includes operating instructions, alignment procedures, and detailed circuit descriptions. J.M.S.

N79-20362# Hughes Research Labs., Malibu, Calif.
HOLOGRAPHIC OPTICAL ELEMENT MATERIALS RESEARCH Final Report, 1 Jan. 1977 - 31 Jul. 1978
A. Graube Nov. 1978 109 p refs
(Contract F44620-76-C-0064)
(AD-A062692; AFOSR-78-1626TR) Avail: NTIS HC A06/MF A01 CSCL 14/5

An experimental program was conducted to study and improve the achievable holographic index modulation in dichromated gelatin suitable for producing high-quality holographic optical elements. Emphasis was placed on gaining a working knowledge of the chemical and physical processes involved in dichromated gelatin image production. The largest improvement in index modulation was achieved with the application of dicarboxylic acid salts. Index modulation could be increased by up to 150% per unit of light exposure over conventional processing methods by taking advantage of unipointly attached reduced chromium complexes. The usefulness of the sol temperature as a measure of bulk cross-linking in gelatin was confirmed. With polycarboxylic acids, index modulations of 0.16 were obtained in reflection holograms. GRA

N79-20363# Washington State Univ., Pullman. Dept. of Chemistry.
PRIMARY PHOTOPROCESSES IN DYES AND OTHER COMPLEX MOLECULES Final Report, Mar. 1967 - Jun. 1978
Maurice W. Windsor 31 Oct. 1978 26 p
(Contracts N00014-75-C-0535; N00014-68-A-0410-003)
(AD-A062568) Avail: NTIS HC A03/MF A01 CSCL 07/3

In this final report a summary of past work and a description of some recent results on triphenylmethane dyes are given. Author (GRA)

N79-20364# Photometrics, Inc., Lexington, Mass.
AN AUTOMATED COORDINATE MEASUREMENT SYSTEM FOR SMOKE TRAIL PHOTOGRAPHS Final Report, 1 Jun. 1977 - 31 Aug. 1978
Christian A. Trowbridge and Winfield Scott Andrus 29 Sep. 1978 43 p ref
(Contract F19628-77-C-0154; AF Proj. 2310)
(AD-A062485; PHM-08-78) Avail: NTIS HC A03/MF A01 CSCL 14/5

A semi automatic Coordinate Measurement System for Photographic imagery is described. The system features the use of computer directed film transport motion and video densitometry to locate, measure, and record the positions of smoke trail images which are used to trace the stratospheric field. GRA

N79-20365# Raytheon Co., Sudbury, Mass. Equipment Div.
MULTIOSCILLATOR RING LASER GYRO Final Technical Report, May 1976 - Jan. 1978
Allen Zampiello and Donald Pasik Sep. 1978 149 p
(Contract F33615-76-C-1218)
(AD-A062257; AFAL-TR-78-133) Avail: NTIS HC A07/MF A01 CSCL 17/7

The reported study developed information on design and fabrication methods peculiar to the multioscillator (four-frequency) ring laser gyro, with study emphasis on gyro cavity sealing problems, and gain medium characterization. Sealing methods

were studied for attachment of anode pins, cathode, and pumpout to the Cer-Vit block. With reasonably cautious procedures, a tri-metal metalization of the Cer-Vit, with pure tin solder, was found to be adequate. Experiments and analytic procedures were used to characterize the AC small signal behavior of the gain medium in terms of equivalent electronic circuits. This was done successfully for specific cases, but more work is needed to relate model parameters to actual gain medium parameters. Other experiments were done to relate power output and stability to various cavity parameters. An analysis was performed relating thermal effects and Fresnel-Fizeau drag as an error source. Verification data was taken on a particular ring laser gyro, showing scale factor linearity of 0.6 ppm, random drift of 0.003 deg/hour 1/2, and turn-on repeatability of 0.05 deg/hour. Author (GRA)

N79-20366# Naval Ship Research and Development Center, Bethesda, Md.
DETERMINATION OF DISPLACEMENTS FROM HOLOGRAMS USING SIMPLY APPLIED METHODS THAT ARE COMPARABLE TO SPECKLE TECHNIQUES
Jerome P. Sikora Dec. 1978 30 p refs Presented at 6th Intern. Conf. for Experimental Stress Analysis, Munich, West Germany, 18-22 Sep. 1978
(AD-A063076; DTNSRDC-78/108) Avail: NTIS HC A03/MF A01 CSCL 17/8

A system of equations is developed which relates the general displacement field from usual and image-plane double exposure holograms of objects illuminated by collimated or point light sources. By defining a coordinate system in the direction of the holographic plate and requiring that the object be several plate diameters from the plate, certain simplifications in the system of equations can be made to decouple the displacement components. As a result, the in-plane components can be independently determined from the apparent fringe shift observed from the holographic plate. The out-or-plane component can then be solved from a linear equation using the in-plane components. All three components of displacement can be simultaneously determined from a single film plate, regardless of the proportion of in- to out-of-plane components. The method is validated by comparisons with speckle results and theoretical analyses. Author (GRA)

N79-20367# Minnesota Mining and Mfg. Co., St. Paul.
CAMERA SPEED DRY SILVER FILM Final Technical Report, May 1974 - Sep. 1977
Robert Russell and Ken Metz Feb. 1978 70 p refs
(Contract F33615-74-C-1081)
(AD-A062757; AFAL-TR-78-8) Avail: NTIS HC A04/MF A01 CSCL 14/5

In order to increase the photosensitivity of Dry Silver, knowledge of both the photosensitive and the thermographic aspect of Dry Silver had to be advanced. In order to increase the photosensitivity, silver halide crystals had to be prepared which were more prone to photolytic reduction. The choice of halide ion and the associatad cation were found to be critical for the highest photosensitivity. The objective of this study was to determine the technical feasibility of formulating, coating, and testing experimental laboratory coatings of dry silver films with panchromatic photosensitivity of AEI-20, and capable of being thermally processed from exposed latent image form to usefully permanent visible silver image form within 30 seconds or less using temperatures less than 300F. The dry silver films coated with high photosensitivity were found to have base fog, and tended to have short, useful package shelf life as well as limited image permanence, and limited reproducibility. Aspects of the experimental panchromatic sensitive dry silver films which require furhter work to provide a more useful film are higher photosensitivity with latent image stability and light stability.
GRA

N79-19996*# Wichita State Univ., Kans.
INSTRUMENTATION, TECHNIQUES AND DATA REDUCTION ASSOCIATED WITH AIRFOIL TESTING PROGRAMS AT WICHITA STATE UNIVERSITY
Edward J. Rodgers, William H. Wentz, Jr., and H. C. Seetharam (Boeing Commercial Airplane Co.) *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 539-558 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 14B

N79-19999*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HOLOGRAPHY AND LDV TECHNIQUES, THEIR STATUS AND USE IN AIRFOIL RESEARCH
D. A. Johnson and W. D. Bachalo (Spectron Development Labs., Inc.) *In* NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 589-599 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 14E

N79-20150*# National Environmental Satellite Service, Washington, D. C.
THE COASTAL ZONE COLOR SCANNER (CZCS) EXPERIMENT
Warren Hovis *In* NASA. Goddard Space Flight Center The Nimbus 7 User's Guide Aug. 1978 p 19-32 refs (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 14B

N79-20156*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR) EXPERIMENT
Per Gloersen and Len Hardis (OAO Corp., Beltsville, Md.) *In its* The Nimbus 7 User's Guide Aug. 1978 p 213-246 refs (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 14B

N79-20157*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE TEMPERATURE HUMIDITY INFRARED RADIOMETER (THIR) SUBSYSTEM
G. Thomas Cherrix *In its* The Nimbus 7 User's Guide Aug. 1978 247-262 (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 14B

N79-20425*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
A PORTABLE HYPERGOLIC OXIDIZER VAPOR SENSOR FOR NASA'S SPACE SHUTTLE PROGRAM
William R. Helms *In its* Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 1-10 refs (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 14B

N79-20979# European Space Agency, Paris (France).
UTILIZATION OF THE CACTUS ACCELEROMETER IN MEASURING THE EARTH'S RADIATIVE BALANCE
Jacques Bouttes, Remy Juillerat, and Anne-Marie Mainguy *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-2 (ESA-TT-496) Nov. 1978 p 78-83 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-2, Mar.-Apr. 1978 p 95-97 Original report in FRENCH previously announced as A78-38700 (For primary document see N79-20974 11-99)
Avail: NTIS HC A05/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N79-20368# Ballistic Research Labs., Aberdeen Proving Ground, Md.
IR SCANNING CAMERA DATA FOR USN-UTRC ACRYLIC TESTS AT 3.8 MICRON RADIATION Final Report
J. E. Kammerer, S. A. Dunbar, and M. T. Reddy Aug. 1978 114 p
(DA Proj. 1L1-62618-AH-80)
(AD-A062100; AD-E430131; ARBRL-MR-02859) Avail: NTIS HC A06/MF A01 CSCL 02/5

Beam diagnostic records are presented for a series of tests using a 3.8 micrometer cw chemical laser to burn acrylic test samples exposed to a range of beam intensities and airflows. The data recording and reduction effort by the Ballistic Research Laboratory is a cooperative effort in conjunction with the

Naval Research Laboratory to determine the feasibility of using acrylic burn patterns to augment beam diagnostic data recorded by an infrared scanning camera system. Author (GRA)

N79-20369# Manchester Coll. of Science and Technology (England).

SYSTEMS FOR STUDY OF PROPAGATION OF CO2 LASER RADIATIONS THROUGH CLOUDS Final Technical Report, May 1977 - Oct. 1978

P. E. Browne and P. M. Webber Oct. 1978 33 p refs
(Grant DA-ERO-77-G-060; DA Proj. 1T1-61102-BH-57)
(AD-A062932) Avail: NTIS HC A03/MF A01 CSCL 20/5

This report describes the design, and progress toward the construction, of systems required for the study of the propagation of 10.6 radiation from CO2 lasers (both high power pulsed and cw) through clouds, both laboratory generated and natural. The laboratory experiments of highest priority are the study of non-linear attenuation of high power TEA laser pulses (of order 10 J/sq cm) through optically thick clouds produced by adiabatic expansion with particular attention to change of pulse shape, and measurements of backscatter. The systems required for these experiements are nearing completion. The field experiments are the study of attenuation, beam quality and backscatter of TEA laser pulses and cw radiation over a return path of the order of 1 km. The systems required are under construction. All lasers and also the transmissometer have been developed within the group. Author (GRA)

N79-20370# Litton Systems, Inc., Morris Plains, N. J. Airtron Div.

THE SINGLE CRYSTAL GROWTH AND LASER ROD FABRICATION OF NEODYMIUM DOPED YTTRIUM VANADATE Final Report, 1 Jul. 1976 - 1 Jul. 1978

Larry E. Drafall and Roger F. Belt Sep. 1978 84 p refs
(Contract DAAB07-76-C-0908)
(AD-A062707; DELNV-TR-76-0908-F) Avail: NTIS HC A05/MF A01 CSCL 20/5

Good quality 41005 YVO4 with 1 atomic % Nd was grown from stoichiometric melts contained in RD heated 50 x 50mm iridium crucibles. Initial growth experiments used reacted phosphor grade YVO4 and Nd:VO4 until the growth parameters of structurally sound crystals were determined. Stoichiometric solid state reactions of the component high purity oxides, V2O5 (-15 ppm impurities), 99.999% Y2O3, and 99.99% Nd2O3 were then used. During growth a significant amount of V2O5 was vaporized which led to changes in melt composition and crystallization temperatures. The YVO4 melt slowly decomposed into YVO3 and O2. High partial pressures of O2 reduced decomposition rates, but the amount of crucible oxidation was very severe. After prolonged heating, V2O5 depletion and sample decomposition limited growth. Experiments indicated YVO4:Nd could be grown from a nonstoichiometric composition of 10 mole% excess Y2O3 at lower temperatures where V2O5 vaporization was noticeably less. The crystal-melt interface and thermal gradient were adjusted to produce the best growth in a 99.5% N2-0.5% O2 atmosphere at a pull rate of 2.54mm/hr and a rotation rate of 4 rpm. Boules of 41005 YVO4:Nd up to 90mm long x 6mm x 20mm were grown with excellent diameter control. Preferred growth occurred along 40015 with large smooth facets on (010) planes the entire boule length. GRA

N79-20371# City Coll. of the City Univ. of New York.

INTERACTIONS AND SCATTERING OF ATOMS Summary Report, Feb. 1978 - Feb. 1979

Marvin H. Mittleman 15 Nov. 1978 9 p refs
(Contract N00014-76-C-0014)
(AD-A061370) Avail: NTIS HC A02/MF A01 CSCL 20/5

Contents: Configuration space Hamiltonian for Heavy Atoms; Laser-Atom Interactions; Electron-Atom Scattering in the presence of a laser field, for resonant laser frequency and for low laser frequency; Resonance Fluorescence; and Statistical Model of Atom-Atom Scattering. GRA

N79-20372*# Rockwell International Corp., Thousand Oaks, Calif. Science Center.

A CHEMICAL SINGLET MOLECULAR OXYGEN GENERATOR Final Report

A. T. Pritt, R. D. Coombe, I. B. Goldberg, D. Pilipovich, and R. I. Wagner Jul. 1978 100 p refs
(Contract F29601-76-C-0070)
(AD-A062091; AD-E200192; AFWL-TR-77-265) Avail: NTIS HC A05/MF A01 CSCL 20/5

A method of generating a continuous wave (cw) 'clean' stream of oxygen containing a large fraction in the singlet state has been developed based upon the base catalyzed chemical reaction of chlorine fluorosulfate and hydrogen peroxide. After the addition of molecular iodine a fast energy transfer process between O2 and I created a population inversion between the spin-orbit states of atomic iodine. This population inversion was directly observed in an optical double resonance experiment in which the excited spin-orbit state population was decreased as the transition was driven toward saturation by a pulsed iodine atom laser. The O2 generator, quantitative diagnostics, optical double resonance experiment, and lasing attempts are described in this report. Author (GRA)

N79-20373# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

RESEARCH ON PROBLEMS RELATED TO LASER COMMUNICATION THROUGH WATER Final Technical Report, Jul. 1973 - Dec. 1978

W. R. Bennett, Jr. 7 Dec. 1978 103 p refs
(Contract N00014-67-A-0097-0021)
(AD-A062443; TR-4) Avail: NTIS HC A06/MF A01 CSCL 17/2

Several of the more intense emission lines from the argon ion laser fall within the blue-green 'transmission window' of sea water. Although relatively modest cw power and efficiency are obtained from argon ion lasers of practical laboratory size, the medium itself has an unusually high gain-bandwidth product when compared to other known gas laser systems. Consequently, it is possible in principle to obtain relatively high peak power pulses at high repetition frequencies from cw argon ion lasers operated in a synchronized cavity-dumped, mode-locked manner. Because such pulse chains might have practical applicability in the area of underwater communication, it seemed appropriate to investigate a number of basic physical problems associated with the production of such mode-locked laser pulse chains and with their applicability in time-interval measurement. A number of new techniques have been developed and new physical observations have been made during the course of this research. A technique based on the two-quantum photoeffect was devised and used to study second-order intensity correlations, pulse shapes and time delays in the picosecond time domain. GRA

N79-20374# Washington Univ., Seattle.

FLUID MECHANICAL REFRACTING GAS PRISM AND AERODYNAMICS OF E - BEAM SUSTAINED DISCHARGE IN SUPERSONIC FLOW, BOTH APPLICABLE TO LASER TECHNOLOGY Interim Scientific Report, 1 Jan. - 31 Dec. 1977

D. W. Bogdanoff and W. H. Christiansen May 1978 101 p refs
(Grant AF-AFOSR-2650-74)
(AD-A062390; AFOSR-78-1494TR) Avail: NTIS HC A06/MF A01 CSCL 20/5

Details are presented of extensive experimental tests of a 90 degree Venus Machine, a fluid mechanical optical control device which deflects a beam of light continuously through large angles. A motion-picture photographic technique was used to obtain extensive data under a variety of operating conditions on the size and shape of the light well, a region in the flow where light rays are trapped in near circular paths. The angular divergence of the laser beam leaving the Venus Machine was also measured for the same range of operating conditions. These experimental results, along with parallel theoretical work, have allowed a reasonably complete understanding of the operation of the present 90 degree device at low laser power levels and have indicated that potential exists for the design of Venus Machines of much higher performance and optical quality. Construction of a ruby laser and the necessary optical and detector systems for high-power Venus Machine transmission was completed. Preliminary calibration measurements with the detector system were made. Other experimental work is underway to find ways of improving the performance of electron-beam sustained electric discharge lasers. Some considerations include discharge boundary

layer interactions and medium homogeneity. Preliminary results of the fundamental mechanisms of the interaction of electrical discharges of the glow type and the fluid mechanics as found in supersonic electric discharge lasers are briefly presented in this report. Author (GRA)

N79-20375# National Technical Information Service, Springfield, Va.
ULTRAVIOLET LASERS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1966 - 1978
Brian Carrigan Feb. 1979 193 p Supersedes NTIS/PS-78/0003; NTIS/PS-76/0993
(NTIS/PS-79/0010/3; NTIS/PS-78/0003; NTIS/PS-76/0923) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

Government-sponsored research on the design, development, theory, and diagnostics of ultraviolet lasers is cited. Studies on molecular reactions, electron transitions, excitation, tuning, and optical pumping of these systems are covered. Materials lasing in these wavelengths and optical equipment for these lasers are also included. This updated bibliography contains 186 abstracts, 42 of which are new entries to the previous edition. GRA

N79-20376# National Technical Information Service, Springfield, Va.
X-RAY LASERS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1969 - 1978
Brian Carrigan Feb. 1979 95 p Supersedes NTIS/PS-78/0004; NTIS/PS-76/0993
(NTIS/PS-79/0011/1; NTIS/PS-78/0004; NTIS/PS-76/0993) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

Citations of Federally-funded research on the theory, design, development, testing, and output of X-ray lasers are presented. Studies on sources, excitation, amplification, pumping, tuning, and optimization of these lasers are included. GRA

N79-19997*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF THE LASER VELOCIMETER TO AIRFOIL RESEARCH
Danny R. Hoad *In its* Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 1978 p 559-570 refs (For primary document see N79-19989 11-01)
Avail: NTIS HC A14/MF A01 CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N79-20377* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SEQUENCING DEVICE UTILIZING PLANETARY GEAR SET Patent
Walter T. Appleberry, inventor (to NASA) (Rockwell International, Downey, Calif.) Issued 27 Feb. 1979 7 p Filed 25 Feb. 1977 Supersedes N77-19459 (15 - 10, p 1319) Sponsored by NASA
(NASA-Case-MSC-19514-1; US-Patent-4,141,259; US-Patent-Appl-SN-772168; US-Patent-Class-74-674; US-Patent-Class-74-705; US-Patent-Class-74-764) Avail: US Patent and Trademark Office CSCL 13I

A planetary (epicyclic) gear set is provided with a reversible rotating input shaft and individual outputs shafts actuated, respectively, by the ring gear and planet gear carrier. Latch means is positioned to selectively and automatically stop the ring gear or carrier member while releasing the other to provide the desired sequential output operation. The output shafts are reversed in sequence and direction of rotation by reversing rotational direction of the input shaft.
Official Gazette of the U.S. Patent and Trademark Office

N79-20378# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
STRATIFICATION ENHANCEMENT IN LIQUID THERMAL STORAGE TANKS
Richard I. Loehrke, J. C. Holzer, H. N. Gari, and N. K. Sharp 12 Mar. 1979 28 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Energy, May-Jun. 1979 (Contracts N68305-76-C-0036; EG-77-S-02-4523)
Avail: NTIS HC A03/MF A01

For many applications a properly designed inlet is the key to achieving and maintaining stratification in a liquid thermal storage tank. Experimental results are presented which compare the performance of several conventional inlet configurations. A porous manifold is described which acts as a passive distributor directing the incoming liquid to the appropriate level in the tank. Experimental data for two versions of this manifold are presented. Several simple stratification models are used to gage the performance of these devices. It is concluded that these models may adequately represent the behavior of a stratified storage system for many applications. Author

N79-20379# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
TEST OPERATIONS PROCEDURE ENGINE COLD STARTING TESTS Final Report
10 Aug. 1978 10 p refs Supersedes MTP-2-2-650 (AD-A062736; TOP-2-2-650; MTP-2-2-650) Avail: NTIS HC A02/MF A01 CSCL 21/2

This report describes procedures for evaluating the cold starting capability of military engines with and without the aid of arctic kit engine heaters. Author (GRA)

N79-20380# Westinghouse Research and Development Center, Pittsburgh, Pa.
DEVELOPMENT OF LIGHT WEIGHT SOLID LUBRICATED BEARING RETAINERS Final Report, 1 Apr. 1977 - 28 Apr. 1978
David J. Boes Sep. 1978 35 p refs
(Contract F33615-77-C-2027; AF Proj. 3048)
(AD-A062764; AFAPL-TR-78-72) Avail: NTIS HC A03/MF A01 CSCL 11/8

A materials development program was undertaken in an effort to develop a high strength-to-weight ratio self-lubricating composite for use as a solid lubricating retainer in ball bearings operating at speeds up to 60,000 rpm. The program encompassed a temperature range from -40 F to 1000 F. Functional tests using 204 and 205 size bearings were run at speeds up to 30,000 rpm and temperatures to 1000 F. Under these operating conditions, a maximum life of 3-1/2 hours was obtained on a 204 size bearing equipped with a Clevite 300 retainer. Attempts to employ light-weight, Teflon impregnated porous metal composites as self-lubricating retainers in high speed ball bearings were unsuccessful. No further testing of these particular materials is anticipated. GRA

N79-20381# Ricardo & Co., Engineers (1927) Ltd., Shoreham-by-Sea (England). Bridge Works.
MODULATED EXHAUST GAS RECIRCULATION SYSTEM FOR LIGHT DUTY DIESEL ENGINES Final Report
D. A. Pike Aug. 1978 221 p refs
(Contract EPA-68-03-2465)
(PB-288939/2; EPA-460/3-78-007) Avail: NTIS HC A10/MF A01 CSCL 21G

It was shown that by the application of a proportion of exhaust gas to the inlet air of a light duty diesel engine the NOx emission in the exhaust can be substantially reduced. A system of exhaust gas recirculation is described which is modulated to reduce the NOx emission of a Mercedes 300D light duty diesel vehicle, to within defined limits of other parameters, such as HC and CO emissions, and performance loss, etc. To offset losses in performance due to the application of EGR, a turbo charger was fitted to the vehicle to provide excess air. No extra fuel was supplied. GRA

N79-20382# Exxon Research and Engineering Co., Linden, N. J. Products Research Div.
RON-INCREASED COMPRESSION RATIO ENGINE DEMONSTRATION (91) Final Report
Patrick E. Godici and Bernard J. Kraus Oct. 1978 24 p refs
(Contract EPA-68-03-2162)
(PB-289959/9; EPA-460/3-78-009) Avail: NTIS HC A99/MF A01 CSCL 21G

An experimental effort was performed to evaluate several

methods of reducing the octane requirement of a 350 DIC engine (1975 California model). Increased squish and two spark plugs per cylinder did not provide the expected gains in this particular application. Aluminum heads and a knock-actuated spark control system were identified as potential methods of reducing octane requirement. The spark control system was incorporated into a vehicle emission control system to enable the use of higher compression ratio heads without substantial losses in emission control and with a gain in fuel economy. GRA

N79-20385# European Space Agency, Paris (France).
CALCULATION OF EXCHANGE COEFFICIENTS FOR HIGH TEMPERATURE TURBINE BLADES
Pierre Michard and Denis Dutoya *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-3 (ESA-TT-522) Dec. 1979 p 86-97 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 133-137 Original report in FRENCH previously announced as A78-47348 (For primary document see N79-20980 11-99)
Avail: NTIS HC A06/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N79-20383# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A THREE VALUED TRUTH MAINTENANCE SYSTEM
David A. McAllester May 1978 33 p refs
(Contract N00014-75-C-0643; Grant NSF NCS-77-04828)
(AD-A062176; AI-M-473) Avail: NTIS HC A03/MF A01 CSCL 06/4

Truth maintenace systems have been used in recently developed problem solving systems. A truth maintenance system (TMS) is designed to be used by deductive systems to maintain the logical relations among the beliefs which those systems manipulate. These relations are used to incrementally modify the belief structure when premises are changed, giving a more flexible context mechanism than has been present in earlier artificial intelligence systems. The relations among beliefs can also be used to directly trace the source of contradictions or failures, resulting in far more efficient backtracking. In this paper a new approach is taken to truth maintenance algorithms. Each belief, or proposition, can be in any one of three truth states, true, false, or unknown. The relations among propositions are represented in disjunctive classes. By representing an implication in a clause the same algorithm that is used to deduce its consequent can be used to deduce the negation of antecedents that would lead to contradictions. A simple approach is also taken to the handling of assumptions and back tracking which does not involve the non-monotonic dependency structures present in other truth maintenance systems. Author (GRA)

N79-20384# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
A STUDY OF TRUNCATED SEQUENTIAL PROBABILITY RATIO TESTS FOR RELIABILITY TESTING AND SOME NEW RESULTS Final Technical Report
Amrit L. Goel Griffiss AFB, N. Y. RADC Oct. 1978 59 p refs
(Contract F30602-75-C-0121)
(AD-A062172; TR-78-11; RADC-TR-78-223) Avail: NTIS HC A04/MF A01 CSCL 14/4

This report documents a new analytical procedure which can be used to analyze and evaluate sequential probability ratio test plans used for reliability demonstration. The methodology developed is capable of evaluating such test plans when the two lines which define the accept, reject regions are either parallel or nonparallel, with or without truncation considerations. Author (GRA)

N79-20385# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.
MICROPROCESSOR UTILIZATION IN ULTRASONIC INSPECTION FLAW GROWTH CLASSIFICATION STUDIES Annual Report
Joseph L. Rose and Graham H. Thomas Aug. 1978 21 p refs
(Contract N00014-77-C-0607)
(AD-A062575; AR-1) Avail: NTIS HC A02/MF A01 CSCL 20/1

Computers are extremely vital to the work that is being performed in many research and development areas in ultrasonic inspection. The underlying purpose of this study was to demonstrate the applicability of microprocessors to the ultrasonic inspection field. The importance of using microprocessors to perform ultrasonic data acquisition and signal analysis is to allow the large, laboratory based computers used for traditional signal processing to be replaced by smaller, inexpensive, and portable processing units. Thus, the computing power now limited to the laboratory could be transported into the field. The emphasis of microprocessor implementation was directed initially towards ultrasonic inspection problems of interest to the U.S. Navy, in particular that problem of inspecting ship hull plates. A second task is also included as part of this microprocessor feasbility study. An advanced ultrasonic inspection problem, that of fatigue crack growth determination, was developed as a possible implimentation test for the microprocessor. Author (GRA)

N79-20386# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.
AN ULTRASONIC NONDESTRUCTIVE TEST PROCEDURE FOR THE EARLY DETECTION OF FATIGUE DAMAGE AND THE PREDICTION OF REMAINING LIFE Annual Report
James M. Carson and Joseph L. Rose Aug. 1978 93 p refs
(Contract N00014-77-C-0607)
(AD-A062574; AR-1) Avail: NTIS HC A05/MF A01 CSCL 20/1

The goal of nondestructive testing may be simply expressed as the detection and complete specification (size, shape, orientation, etc.) of flaws. This is seldom possible, however. The most dangerous flaw is one that is crack-like or that serves as a crack initiation site. A procedure to detect and estimate fatigue damage occurring at such a site is reported. A computer based data acquisition system is used to analyze data from 2024-T4 Al fatigue specimens containing a through hole. Specimens are fatigue loaded to produce a spectrum of damage levels and interrofated using a simple contact 10 MHz shear wave system. Features selected from the signal amplitude time, spectrum, and cepstrum signatures are used in a computer learning network to make an early detection of fatigue damage and a quantitative prediction of remaining life. A scanning microscope is used to examine the damage at the limit of detection. Fatigue damage was sensed with 92% success after 10% of specimen life. Estimates of damage were made within + or - 20 of the actual fatigue life percentage for 76% of the data. Author (GRA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N79-20387 California Univ., Berkeley.
A SUBSTRUCTURE TECHNIQUE FOR NONLINEAR STATIC AND DYNAMIC ANALYSIS Ph.D. Thesis
Dennis George Row 1978 191 p
Avail: Univ. Microfilms Order No. 7904588

A procedure for structural description is presented, which is a generalization of standard finite element assembly. The relation of each actual substructure to the complete structure is mapped through a connectivity tree. This tree provides the basis for data management and implementation of a systematic analysis procedure. The technique is formulated for nonlinear static and dynamic step-by-step analysis. With solution strategies, nonlinear static or dynamic analysis requires a large number of step-by-step

linear analyses. Structures assembled as a single unit, require a complete reanalysis at each step, if the nonlinearities are localized. A major computational advantage of the substructure technique is that only those substructures which change in behavior need to be reanalyzed at each step. Procedures for the direct solution of linear algebraic equations are reviewed and a Cholesky based algorithm is presented. The substucture technique is implemented for nonlinear static analysis. Dissert. Abstr.

N79-20388 California Univ., Berkeley.
HYSTERETIC BEHAVIOR OF REINFORCED CONCRETE COLUMNS SUBJECTED TO HIGH AXIAL AND CYCLIC SHEAR FORCES Ph.D. Thesis
Stanley William Zagajeski 1978 324 p
Avail: Univ. Microfilms Order No. 7904664

An investigation of the inelastic behavior of short reinforced concrete columns is presented. The results of both experimental and analytical studies are reported. Dissert. Abstr.

N79-20389 Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
STRESS-STRAIN AND FATIGUE LIFE BEHAVIOUR OF UNNOTCHED AND NOTCHED SPECIMENS AND COMPONENTS
H. Nowack and H. Lowak 1978 13 p refs Repr. from Z. Werkstofftech. (West Ger.), no. 9, 1978 p 413-424 In GERMAN; ENGLISH summary
(ICAF-1064) Copyright. Avail: Issuing Activity

In contrast to unnotched specimens where the cross section and the surface area are uniformly deformed, when external loads are applied at the specimens, notched specimens and components show severe concentrations of stress and deformations at the notches. In the paper different types of notches are considered and the effect of the notches under different loading conditions (monotonic, cyclic loading) are described. Some possibilities for predicting the crack initiation of notched components are also outlined and the effect of corrosive environments is briefly discussed. Author

N79-20390*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF WING SHIELDING EFFECTS ON CTOL ENGINE NOISE
Harry E. Bloomer 1979 34 p refs Presented at the 5th Annual Aeroacoustics Conf., Seattle, 12-14 Mar. 1979; sponsored by AIAA
(NASA-TM-79078; E-9895) Avail: NTIS HC A03/MF A01 CSCL 20K

A full scale engine wing shielding investigation was conducted at the Lewis Research Center using a 97,900-N (22,000 lb) thrust turbofan engine and a simulated wing section sized around a conventional-take-off type four-engine narrow body airplane. Sound data were obtained for the wing placed at seven positions in a plane parallel to the engine axis, and were compared to data obtained without the wing at both take off and approach power. In addition, the engine was operated with and without extensive acoustic treatment, including a sonic inlet in order to evaluate wing shielding effectiveness with a highly suppressed engine. The wing shielding effectiveness was also calibrated using a 3.8 cm diam air nozzle as a second source. Results indicated that even though about 10 dB broad band shielding was achieved, the equivalent flyover noise reduction was less than 3.0 EPNdB for most configurations. Author

N79-20391*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME ASPECTS OF A FREE JET PHENOMENA TO 105 L/D IN A CONSTANT AREA DUCT
R. C. Hendricks 1979 41 p refs Proposed for presentation at the 15th Intern. Congr. of Refrig., Venice, 23-29 Sep. 1979; sponsored in part by the Intern. Inst. of Refrig.
(NASA-TM-79050; E-9867) Avail: NTIS HC A03/MF A01 CSCL 20K

Under certain conditions, inlets with a Borda type geometry were shown to exhibit sufficiently strong separation effects to permit the working fluid to flow through the duct as if it were a free jet. Mass limiting flow data and associated pressure profiles for tubes of 14, 53, 64, 73, and 105 L/D with a Borda type inlet were taken to determine bounds of the free jet phenomena. For a given tube roughness, the limits appear to be one dimensional and dependent only on inlet stagnation conditions. For smooth tubes the upper L/D boundary is related by P sub R roughly equal to CT to the 17th power and sub R, C roughly equal to 00017 (L/D) to the 2.5 power where F sub R = P/P sub c is reduced pressure and T sub R = T/T sub c is reduced temperature. The lower bound appears to be saturation conditions at the inlet. Similar free jet effects were found for fluid hydrogen indicating that fluid jetting may be common to all fluids. While limited data on surface roughness show a decrease in the upper L/D limit, nevertheless fluid jetting still occurred. L.S.

N79-20392*# California Univ. at Los Angeles.
NONLINEAR EQUATIONS OF EQUILIBRIUM FOR ELASTIC HELICOPTER OR WIND TURBINE BLADES UNDERGOING MODERATE DEFORMATION Final Report
Aviv Rosen and Peretz P. Friedman Dec. 1978 105 p refs Prepared for DOE
(Grant NsG-3082; Contract E(49-26)-1028)
(NASA-CR-159478; DOE/NASA/3082-78/1; UCLA-ENG-7718) Avail: NTIS HC A06/MF A01 CSCL 20K

The equations are derived for the case of small strains and moderate rotations (slopes). For the convenience of potenial users the equations are developed with respect to two different systems of coordinates, the undeformed and the deformed coordinates of the blade. The loads acting on the blade are given in a general form so as to make them suitable for a variety of applications. Author

N79-20393*# National Aeronautics and Space Administration, Washington, D. C.
RIGIDITY OF LATTICE DOMES
V. A. Savelyev Mar. 1979 29 p refs Transl. into ENGLISH from the book "Metallicheskiye Konstruktsii" Moscow, Stroyizdat Press, 1966 p 325-339 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75387) Avail: NTIS HC A03/MF A01 CSCL 20K

The means of ensuring total rigidity of lattice domes, using comparison with solid shells of 1-3 layers are discussed. Irregularities of manufacture, processing, and other factors are considered, as they relate to diminution of rigidity. The discussion uses the concepts of upper and lower critical loads on the structure in question. G.Y.

N79-20394# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
FUNDAMENTAL AND APPLICATION ORIENTED RESEARCH IN THE FIELD OF STRUCTURAL FATIGUE [PRAXIS-UND GRUNDLAGENBEZOGENE FORSCHUNGSERGEBNISSE AUS DEM GEBIET DER BETRIEBSFESTIGKEIT]
O. Buxbaum, ed. 1978 168 p refs In GERMAN Presented at the 3d Colloq. of the Lab. fuer Betriebsfestigkeit, Darmstadt, West Ger., 19-20 Jun. 1978
(TB-139(1978); ICAF-1066) Avail: NTIS HC A08/MF A01

The papers which were presented at the third Colloquium of the Laboratorium are reported. Topics discussed include: cyclic elasto-plastic behavior of materials on component fatigue life, fail-safe design of water turbine wheels, fatigue strength of thick structural steel weldings, high-strength fiber-reinforced composite materials, deriving statistical parameters for the simulation of working stresses, assessment of load spectra for truck components, load transfer of joints, design criteria in the low-cycle fatigue range, and criteria for the optimum design of welded compressor disks. Author

N79-20395# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
THE INFLUENCE EXERTED BY WELD SEAM THROAT AND PLATE THICKNESS ON THE FATIGUE STRENGTH OF WELD JOINTS MADE BY MEANS OF FILLET WELDS
E. Haibach, R. Olivier, and W. Ritter 1978 4 p refs Repr. from Schweissen und Schneiden (Dusseldorf), v. 30, no. 11, 1978 p 442-446 In GERMAN; ENGLISH summary
(ICAF-1065) Avail: NTIS HC A02/MF A01

An investigation was carried out to determine the influence

exerted by weld seam throat and plate thickness on the fatigue strength of the transition areas of fillet welds. The statistical test program covered angular test pieces made from grade MRSt 37-2 steel embraced twelve variations in fabrication technology. The testing of test pieces in both the as welded and stress relieved states under alternating stress conditions gave an indication of the influence exerted by residual welding stresses. In all the cases of the fabrication variations involved, the fatigue strength value decreased with increasing weld throat thickness. Local strain measurements made in the weld seam transition area indicated that this was largely due to a geometric amplitude factor. G.Y.

N79-20396# Aeronautical Research Inst. of Sweden, Stockholm.
BUCKLING OF SANDWICH PANELS SUBJECTED TO AXIAL COMPRESSION, SHEAR FORCES AND LATERAL PRESSURE. PART 1: EXPERIMENTAL INVESTIGATION
V. Gamziukas and L. A. Samuelson 1977 123 p refs
(FFA-132) Avail: NTIS HC A06/MF A01

A comprehensive experimental study of the buckling behavior of aluminum sandwich panels with an aluminum honeycomb core was performed. Four identical panels were built together into a test box with a square cross section which was subjected to an axial force in combination with an internal pressure and a torsional moment. Results are presented from a test series of 4 monocoque aluminum panels and 4 sandwich panels all with simply supported edges and subjected to pure axial compression. An outline of the theoretical method used to predict the critical load of a sandwich panel is given and some comparisons between numerical and theoretical results are presented. G.Y.

N79-20397*# McDonnell-Douglas Corp., St. Louis, Mo.
HIGH HEAT FLUX ACTIVELY COOLED HONEYCOMB SANDWICH STRUCTURAL PANEL FOR A HYPERSONIC AIRCRAFT Final Report
L. C. Koch and L. L. Pagel Dec. 1978 172 p refs
(Contract NAS1-12919)
(NASA-CR-2959) Avail: NTIS HC A08/MF A01 CSCL 20K

The results of a program to design and fabricate an unshielded actively cooled structural panel for a hypersonic aircraft are presented. The design is an all-aluminum honeycomb sandwich with embedded cooling passages soldered to the inside of the outer moldline skin. The overall finding is that an actively cooled structure appears feasible for application on a hypersonic aircraft, but the fabrication process is complex and some material and manufacturing technology developments are required. Results from the program are summarized and supporting details are presented. G.Y.

N79-20398*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF HIGH VELOCITY IMPACT ON HYBRID COMPOSITE FAN BLADES
C. C. Chamis and J. H. Sinclair 1979 17 p refs Presented at the 20th Structures, Structural Dyn. and Mater. Conf., St. Louis, Mo., 4-6 Apr. 1979; cosponsored by AIAA, ASME, ASCE, and AHS
(NASA-TM-79133; E-9979) Avail: NTIS HC A02/MF A01 CSCL 21E

Recent developments in the analysis of high velocity impact of composite blades are described, using a computerized capability which consists of coupling a composites mechanics code with the direct-time integration features of NASTRAN. The application of the capability to determine the linear dynamic response of an interply hybrid composite aircraft engine fan blade is described in detail. The results also show that the impact stresses reach sufficiently high magnitudes to cause failures in the impact region at early times of the impact event. G.Y.

N79-20399# Aeronautical Research Labs., Melbourne (Australia).
AN INTRODUCTION TO THE USE OF ISOPARAMETRIC ELEMENTS WITH EXAMPLES FROM THE TORSION PROBLEM
Brian C. Hoskin and Beryl I. Green Aug. 1978 34 p refs
(ARL/STRUC-Rept-372; AR-001-292) Avail: NTIS HC A03/MF A01

An introductory account is given of the use of isoparametric elements in finite element structural analysis. The basic theory is described and two simple examples are worked out in detail; these both relate to the torsion of bars. Brief mention is also made of other applications of isoparametric elements. Author

N79-20400# Aeronautical Research Labs., Melbourne (Australia).
STEADY STATE BEHAVIOUR OF A CABLE USED FOR SUSPENDING A SONAR BODY FROM A HELICOPTER
N. E. Gilbert May 1978 41 p refs
(ARL/AERO-Rept-149; AR-001-269) Avail: NTIS HC A03/MF A01

A three-dimensional steady state mathematical model of a cable used to suspend a sonar body from a helicopter is derived. Results are presented in dimensionless form for a length of cable totally immersed in any Newtonian fluid, and may therefore be applied to a number of practical problems. Various approximations are made in order to obtain analytical solutions. Author

N79-20401# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
STUDY OF RESIDUAL STRESSES AND DISTORTION IN STRUCTURAL WELDMENTS IN HIGH-STRENGTH STEELS Progress Report
K. Masubuchi and A. Papazoglou 10 Oct. 1978 44 p
(Contract N00014-75-C-0469)
(AD-A062777; PR-1) Avail: NTIS HC A03/MF A01 CSCL 11/6

The objective of this research program, which started on December 1, 1977, is to study analytically and experimentally residual stresses and distortion in structural weldments in high-strength steel. The program includes (1) generation of experimental data and (2) development of analytical systems. HY-130 is the primary material to be investigated; a limited number of experiments are, however, to be done with low-carbon steel. Experiments are to be made using two welding processes, multipass gas metal arc welding processes and electron-beam welding (one pass). GRA

N79-20402# Stanford Univ., Calif. Div. of Applied Mechanics.
PHENOMENA OF SECOND FRACTURE IN STRUCTURAL DYNAMICS Final Report, 1 Oct. 1974 - 31 May 1978
George Herrmann Dec. 1978 7 p
(Grants DAAG29-77-C-0010; DAHC04-74-G-0177)
(AD-A062973; ARO-11720.3-F) Avail: NTIS HC A02/MF A01 CSCL 13/13

The dynamic fracture response of a long beam of brittle elastic material subjected to pure bending was studied first. If the magnitude of the applied bending moment is increased to a critical value, a crack will propagate from the tensile side of the beam across a cross section. An analysis is presented by means of which the crack length and bending moment at the facturing section are determined as functions of time after fracture initiation. The main assumption on which the analysis rests is that, due to multiple reflections of stress waves across the thickness of the beam, the stress distribution on the prospective fracture plane ahead of the crack may be adequately approximated by the static distribution appropriate for the instantaneous crack length and net section bending moment. GRA

N79-20403# Boeing Aerospace Co., Seattle, Wash. Engineering Technology Div.
INVESTIGATION OF FINITE ELEMENTS FOR STRONGLY NONLINEAR PROBLEMS Final Report, 15 Jun. 1976 - 1 Aug. 1978
R. E. Jones and J. L. Arnquist Oct. 1978 71 p
(AD-A062622; AFOSR-78-1484TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

This final report summarizes the results of an evaluation of two new plate and shell elements for use in large deflection nonlinear analysis. The elements are of the 'stability element' type, in which nonlinear strains are included in calculations, with their values optimized by added membrane displacement functions and special types of elemental level constraints. The report summarizes the formulation and implementation of the elements, and discusses numerical results in detail. Conclusions are drawn regarding the effectiveness of these elements for solving highly nonlinear problems and also for solving certain types of linear shell structure problems. The crucial role of stepping/iterative

solution procedures is discussed, and solution procedures of improved convergence are described. Finally, nonlinear finite element alternatives are discussed from the points of view of accuracy, computing cost, element size, discretization considerations, and solution convergence. Author (GRA)

N79-20404# Battelle Columbus Labs., Ohio.
WATER-DROPLET IMPACT-CHARACTERIZATION OF DAMAGE MECHANISMS Final Technical Report
R. G. Hoagland and R. G. Jung Nov. 1978 78 p
(Contract N00014-76-C-0645)
(AD-A062492) Avail: NTIS HC A05/MF A01 CSCL 20/4

The impact of a water drop on a solid surface produces a transient stress pulse which can damage the surface by plastic deformation and cracking. The consequence of this damage has important technological implications in diverse areas. Water droplet damage, like cavitation damage, is most typically characterized as an erosion process reflecting material removed with time. Indeed, measurements of material removal rates during repetitive impacting under standardized conditions are a common means of ranking materials for comparison of erosion resistance. However, the development of surface roughness (due to deformation or material removal) and damage in the surface layer during repetitive impacting greatly complicates a detailed analysis of individual impact events. In fact, qualitative descriptions of erosion show that several mechanisms may be involved at different times in the erosion process, leading to distinct stages. It is also clear that the conditions which will eventually lead to material removal are developed by sonic and subsonic droplets in the initial stage of erosion when the density of impacts is low. GRA

N79-20405# Virginia Polytechnic Inst. and State Univ., Blacksburg.
DYNAMIC SIMULATION OF COMPLEX STRUCTURES Interim Technical Report, 1 Jan. - 31 Oct. 1978
Leonard Meirovitch and Arthur L. Hale Nov. 1978 42 p refs
(Grant DAAG29-78-G-0038)
(AD-A062618; ARO-15243.1-E; ITR-1) Avail: NTIS HC A03/MF A01 CSCL 13/13

This investigation is concerned with the dynamic simulation of complex structures consisting of an assemblage of substructures. Each of the substructures possesses a large number of degrees of freedom. In fact, in theory a continuous substructure has an infinite number of degrees of freedom, but for practical reasons each of the substructures must be simulated by a limited number of degrees of freedom. The component mode synthesis method advocates representing the substructure motion by a given number of substructure modes. In an earlier paper, the authors of this report have argued that component modes are actually not necessary and admissible functions suffice. Equally important is the treatment of discrete substructures with a large number of degrees of freedom. To simulate the motion of such substructures, these authors are advancing the concept of 'admissible vectors'. The first phase of the research has concentrated on the development of this concept and placing it on a sound mathematical foundation as well as developing methods for producing such vectors. To introduce the above ideas, a discrete model consisting of a rotating lumped-parameter cantilever beam was used. Such a model is of special interest, as it can be regarded as simulating a helicopter blade.
Author (GRA)

N79-20406# Massachusetts Inst. of Tech., Cambridge. Dept. of Astronautics and Aeronautics.
THE NATURAL MODE SHAPES AND FREQUENCIES OF GRAPHITE EPOXY CANTILEVERED PLATES AND SHELLS Final Report
Edward F. Crawley and Sung Won Lee Aug. 1978 146 p refs
(Contract F33615-77-C-5155; Grant AF-AFOSR-3335-77; AF Proj. 2307)
(AD-A062582; AFFDL-TM-FBR-78-110) Avail: NTIS HC A07/MF A01 CSCL 11/4

The natural mode shapes and frequencies of graphite/epoxy and graphite/epoxy/aluminum cantilevered plates and cylindrical shell sections are investigated. A single assumed mode partial Ritz analysis is used to determine the frequencies of orthotropic cantilever plates. The results suggest a method for preliminary design and frequency nondimensionalization. The assumed stress hybrid shell element RS40 which includes the effects of transverse shear is used to model a set of laminated cantilevered plates and shells. When this set of plates and shells was then built and tested, the frequencies predicted by RS40 showed reasonable agreement with experimental values, and the predicted and observed mode shapes were in excellent agreement.
Author (GRA)

N79-20407# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
VIBRATORY RESPONSE OF A ROTATING DISK INCORPORATING IMAGE DEROTATION TECHNIQUES AND HOLOGRAPHIC INTERFEROMETRY Final Report, 1 Jun. - 1 Dec. 1977
John E. Horner, James C. MacBain, and William A. Strange Sep. 1978 62 p
(AD-A062671; AFAPL-TR-78-62) Avail: NTIS HC A04/MF A01 CSCL 20/11

This report covers work carried out at AFAPL's Turbo Structures Research Laboratory (TSRL) on the vibratory response of an internally clamped annular disk under both static and rotational conditions, incorporating an image derotator and 10 inch disk under nonrotating conditions. Incorporating an image derotator and double-pulsed ruby laser, resonant conditions and mode shapes were again determined, but this time the interferograms were constructed while the disk was rotating at specified speeds. The finite element computer program NASTRAN was used to model the steel disk and analytically determine the mode shapes and frequencies as a function of speed. The analytical frequency predictions were compared to the experimental results and found to deviate by about 4%. Author (GRA)

N79-20408# Sydney Univ. (Australia). Civil Engineering Labs.
CROSS-SECTION BEHAVIOUR AND DUCTILITY IN COMPOSITE BEAMS
J. M. Rotter and P. Ansourian Sep. 1978 50 p refs
(PB-289522/5) Avail: NTIS HC A03/MF A01 CSCL 13M

The conditions required for a composite beam to exhibit ductile sagging behavior are investigated. Variations in the elastic and inelastic response of a composite beam in sagging bending are also studied. The effects of material properties, geometry, residual stresses, and interface slip are all examined. From a wide range of cross-sections, the form of a standard moment-curvature curve is determined. Simple analytical expressions are derived which give an approximate but quite accurate prediction of the form of the complete curve throughout the elastic and inelastic range. The criterion which determines whether a beam is ductile or strain-softening is deduced directly from this simple analysis. GRA

N79-20409# Advisory Group for Aerospace Research and Development, Paris (France).
FRACTURE MECHANICS DESIGN METHODOLOGY
Jan. 1979 236 p refs AGARD lecture series presented at Delft, The Netherlands, 5-6 Oct. 1978; Munchen, Germany, 9-10 Oct. 1978; Sacavem, Portugal, 12-13 Oct. 1978
(AGARD-LS-97; ISBN-92-835-1294-4) Copyright. Avail: NTIS HC A11/MF A01

The state of the art of the application of fracture mechanics to the fail safety and damage tolerance assessment of aircraft structures is examined. Basic principles of fracture mechanics are reviewed. It is shown that although damage assessment analysis has passed the stage where tests were the only means to get answers to pertinent questions regarding crack growth and residual strength, tests are still indispensable. For individual titles, see N79-20410 through N79-20420.

N79-20410# Battelle Columbus Labs., Ohio.
INTRODUCTION TO FRACTURE MECHANICS
David Broek *In* AGARD Fracture Mech. Design Methodology Jan. 1979 1 p refs (For primary document see N79-20409 11-39)
Avail: NTIS HC A11/MF A01

The development of the fracture mechanics discipline for computing and predicting the behavior of flaws and cracks during damage tolerance analysis is summarized. Topics discussed include

stress intensity factor, the parameter for crack growth and fracture, plane stress and plane strain, toughness and residual strength, subcritical crack growth, and the energy release rate. A.R.H.

N79-20411# Battelle Columbus Labs., Ohio.
FRACTURE
David Broek *In* AGARD Fracture Mech. Design Methodology Jan. 1979 15 p refs (For primary document see N79-20409 11-39)
Avail: NTIS HC A11/MF A01

Because the larger part of the primary structure of large civil aircraft consists of reinforced thin plate, plane stress fracture is of vital importance for all major aircraft components. The behavior of thin plates and the analysis of plane stress fracture are discussed. Plane stress behavior is more difficult to analyze than plane strain behavior and has received relatively little attention in the literature. Fracture under plane stress conditions is more complex than plane strain fracture, and no rigorous analysis procedures exist. However, for most practical purposes useful engineering methods can provide approximative answers to plane stress fracture problems. Plane stress and transitional fracture are examined. A.R.H.

N79-20412# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
FATIGUE CRACK GROWTH
Walter Schutz *In* AGARD Fracture Mech. Design Methodology Jan. 1979 13 p (For primary document see N79-20409 11-39)
Avail: NTIS HC A11/MF A01

It is now an established fact that structures may go into service containing crack-like manufacturing defects. However, only in very rare cases these cracks are so large that immediate static failure occurs when the first high service loads occur; rather, it is the service loads themselves which produce crack growth starting either from the small manufacturing cracks or from notches which are unavoidable in a structure. In the first case, the whole life of the structure consists of crack growth; it ends when the remaining cross section can no longer sustain the service loads and fails statically. In the second case, at the notch root a crack must first be initiated which then grows to failure and the life consists of the crack initiation and the crack propagation phase. In both cases, crack propagation and its calculation is therefore an important task at least as important as the calculation of residual static strength and much more difficult. This is so because fatigue crack propagation is a cyclic phenomenon and is therefore much more complex and difficult than a static phenomenon. One reason is the very large number of parameters; therefore, experimental verification of calculation methods, hypotheses etc. is very time-consuming and expensive. Author

N79-20413# Northrop Corp., Hawthorne, Calif. Aircraft Group.
STRESS INTENSITY ANALYSIS: ANALYTICAL, FINITE ELEMENT FOR SURFACE FLAWS, HOLES
D. P. Wilhem *In* AGARD Fracture Mech. Design Methodology Jan. 1979 19 p refs (For primary document see N79-20409 11-39)
Avail: NTIS HC A11/MF A01

Several methods are available to obtain stress intensity for developing cracks in structure where uniform loading and symmetric cracks prevail. Unfortunately in all aircraft structure both loading (stress) and crack geometries are far from ideal. These factors combined with localized plasticity require the use of more sophisticated means of obtaining stress intensity factors. Finite element analysis, both with and without special cracked elements, can be used to obtain stress intensity values. Careful attention must be paid in modeling to account for various factors, i.e., fasteners, etc., which affect the stress field. In many cases where elastic-plastic behavior is evident, those finite element programs with nonlinear capability can be effectively used to compute J-integral values for use in both fatigue and fracture studies. One case study presented involves a cutout in the wing in a highly stressed region the root. Other cases deal with part-through-cracks at holes and countersinks and other design details. The use of three dimensional finite element models to obtain stress intensities for cracks at holes provides an opportunity to evaluate the merits of each method of analysis; analytical, finite element and semi-empirical. Comparisons are presented for several cases. A.R.H.

N79-20414# Douglas Aircraft Co., Inc., Long Beach, Calif.
DAMAGE TOLERANCE ANALYSIS OF REDUNDANT STRUCTURES
T. Swift *In* AGARD Fracture Mech. Design Methodology Jan. 1979 34 p refs (For primary document see N79-20409 11-39)
Avail: NTIS HC A11/MF A01

A modern transport aircraft contains wide expanses of basic redundant structure which must be designed with some damage tolerance capability. Reliable and economical analytical procedures are therefore required to ensure the most efficient design which will meet these damage tolerance requirements. Several kinds of analytical approaches are described including finite-element, energy release rate, and displacement compatibility methods. Each of these methods can be used to calculate the crack tip stress intensity and stiffener stress concentration factors necessary for the damage tolerance design of stiffened structure. The role that stiffeners play in reducing the crack tip stress intensity factor to a level which can arrest cracks after rapid propagation is described. The effects of variations in geometry on the crack tip stress intensity factor, stiffener stress, and residual strength are presented, including the results of a parametric study. Finally, analytical procedures are described which account for fastener nonlinear shear displacement and the effects of stiffener plasticity. Author

N79-20415# Battelle Columbus Labs., Ohio.
FATIGUE CRACK GROWTH ANALYSIS
David Broek *In* AGARD Fracture Mech. Design Methodology Jan. 1979 19 p refs (For primary document see N79-20409 11-39)
Avail: NTIS HC A11/MF A01

Basically, damage tolerance means that (real or assumed) cracks do not grow, within a certain defined period, to a size that would cause loss of the aircraft at a specified load. Damage-tolerance assessment involves analysis of fatigue and environmentally assisted growth of an initial flaw under the anticipated service loading, and the residual strength characteristics of the cracked structure. In principle, present day fracture mechanics and modern stress analysis techniques permit the prediction of residual strength characteristics of many structures. Techniques for dealing with random or quasi-random service-load histories were recently proposed. The adequacy of these new techniques for crack growth predictions is examined. Because the load spectrum and the stress history are the most important ingredients of a crack growth analysis, the development of an adequate stress history is discussed. A.R.H.

N79-20416# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
DESIGN OF HEAVY SECTIONS
Walter Schutz *In* AGARD Fracture Mech. Design Methodology Jan. 1979 11 p refs (For primary document see N79-20409 11-39)
Avail: NTIS HC A11/MF A01

Because most highly loaded heavy section airframe components are manufactured either from plate or from forging, their crack propagation and residual static strength properties are of interest to the designer, the certification authorities, and the operator. If heavy section components are made from plate their final shape is obtained by machining-interrupting the grain flow. For many forgings the original shape is hardly changed by machining. However, there may be differences in grain flow between individual forgings. The available fracture mechanics data of plate or forged aircraft materials are reviewed; finally, some qualitative suggestions and quantitative results are given for use by the designer of heavy sections. A.R.H.

N79-20417# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
TREATMENT OF SCATTER OF FRACTURE TOUGHNESS DATA FOR DESIGN PURPOSES
Walter Schutz *In* AGARD Fracture Mech. Design Methodology Jan. 1979 20 p refs (For primary document see N79-20409 11-39)
Avail: NTIS HC A11/MF A01

The numerical values used in fracture mechanics calculations depend on material properties. Therefore they have an inherent scatter - like all material data. For design puposes, this scatter must be accounted for either by safety factors or by suitable statistical procedures. The mathematical procedures as such are relatively simple and well known; it is, however, a most difficult question which numerical values to use in such a calculation, for example for the coefficient of variation of fracture toughness; this is so because such numerical values are still very scarce, as they are much more difficult and expensive to determine than, for example, fracture toughness values. Also, fracture toughness may be much more sensitive to slight variations in heat treatment than the mormal mechanical properties; this may result in large differences of fracture toughness between different heats of a nominally identical material. Author

N79-20418# Douglas Aircraft Co., Inc., Long Beach, Calif.
DESIGN OF REDUNDANT STRUCTURES
T. Swift *In* AGARD Fracture Mech. Design Methodology Jan. 1979 23 p refs (For primary document see N79-20409 11-39)
Avail: NTIS HC A11/MF A01

The selection of damage sizes to be used in the design of a large commercial transport aircraft is discussed. Development tests are described which assess the capability of different materials and structural configurations to meet the selected criteria. Correlation of various analytical methods is shown for varying degrees of damage for both fuselage and wing structural arrangements. A limited number of tests are described which verify the chosen inspection intervals for externally detectable damage after internal member failure. A.R.H.

N79-20419# Northrop Corp., Hawthorne, Calif. Aircraft Group.
ANALYSIS OF AIRCRAFT STRUCTURE USING APPLIED FRACTURE MECHANICS
D. P. Wilhem *In* AGARD Fracture Mech. Design Methodology Jan. 1979 17 p refs (For primary document see N79-20409 11-39)
Avail: NTIS HC A11/MF A01

An aircraft designed and analyzed for a particular set of usages is often placed in a service environment which is more severe than originally planned. The consequence of this occurrence is that many design details such as cutouts, holes, etc., are placed in a spectrum of loads which result in higher operating stresses. In the original full scale fatigue test, a different (design usage) spectrum is usually employed, and can only indicate fatigue critical areas. Using the finite element approach with stress intensity values and usage spectra, estimates are made of the crack growth life for a part-through-crack at a cutout. These data are then used to establish inspection intervals. Three distinct spectra were developed to represent usage, and analytical/experimental correlation was made for those spectra. In the majority of cases, good agreement was obtained. For these cases where the correlation is not good, refinements need to be made to the stress intensity solutions and/or the crack growth model. The reliance on more than one method of analysis is recommended for stress intensity evaluation of fatigue and fracture-critical areas. A comparison of the methods used in determining crack growth parameters sometimes indicates that the added cost of a more complex technique is not warranted, particularly when parametric design studies are involved. The use of a newer approach to the prediction of both fatigue crack growth and residual strength, employing a wide range resistance curve, is promising. Its usefulness in pinpointing differences in the cutout problem is given. A.R.H.

N79-20420# Battelle Columbus Labs., Ohio.
DAMAGE TOLERANCE IN PRACTICE
David Broek *In* AGARD Fracture Mech. Design Methodology Jan. 1979 13 P refs (For primary document see N79-20409 11-39)
Avail: NTIS HC A11/MF A01

Some practical aspects in the application of damage tolerance criteria in the design and operation of aircraft are discussed, including the complete fracture control plan. Rules issued by various authorities specifying the required damage tolerance of the airplane structure are reviewed. The problem of the application of safety factors is particularly from the point of view of crack-growth prediction. Because substantial testing is still necessary (and also required by the authorities) damage tolerance testing is examined, which offers a possibility for a continuous updating of the predictions of life expectancy and facilitates management decisions. Fleet monitoring is a logical extension of the fracture control plan. A.R.H.

N79-20421# Advisory Group for Aerospace Research and Development, Paris (France).
SELECTION OF STRUCTURAL ANALYSIS COMPUTER PROGRAMS
L. V. Andrew and I. C. Taig Jan. 1979 25 p refs Presented at the 47th Struct. and Mater. Panel Meeting, Florence, Sep. 1978
(AGARD-R-670; ISBN-92-835-1305-3) Avail: NTIS HC A02/MF A01

The technical and administrative course of action in selecting computer programs are presented. For individual titles, see N79-20422 through N79-20423.

N79-20422# Rockwell International Corp., Downey, Calif.
ROCKWELL INTERNATIONAL'S SUBCOMMITTEE FOR COMPUTERIZED STRUCTURAL ANALYSIS
L. V. Andrew *In* AGARD Selection of Struct. Anal. Computer Programs Jan. 1979 p 1-10 refs (For primary document see N79-20421 11-39)
Avail: NTIS HC A02/MF A01

How the Ad-Hoc SCSA scoped the task of evaluating the computer programs, how it developed the basis for its evaluations and recommendations and how it presents tables that define the grading system that emerged are described. The compilation of the final report which still serves as a guide for the permanent SCSA formed in 1974 was examined. The SCSA formed ASKA and NASTRAN Configuration Control Boards to control the maintenance and development of the programs. The function of these boards in certification of the computer programs and the function of the SCSA in Rockwell Group Services Project reviews are discussed. Some recommendations are made to those who must select computer programs from those that are available. S.E.S.

N79-20423# British Aerospace Aircraft Group, Warton (England).
SELECTION CRITERIA FOR STRUCTURAL ANALYSIS PROGRAM
I. C. Taig *In* AGARD Selection of Struct. Anal. Computer Programs Jan. 1979 p 11-19 (For primary document see N79-20421 11-39)
Avail: NTIS HC A02/MF A01

A procedure to help the user make the best selection of structural analysis programs is presented. A procedure is discussed which includes the following three stages: (1) initial screening; (2) formal assessment; (3) management decision. S.E.S.

42 GEOSCIENCES (GENERAL)

N79-20424*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PROCEEDINGS OF THE NASA/FLORIDA INSTITUTE OF TECHNOLOGY ENVIRONMENTAL ENGINEERING CONFERENCE ON NITROGEN TETROXIDE
Eric L. Rhodes Jun. 1978 203 p refs Conf. held at Melbourne, Fla., 30-31 Mar. 1978
(NASA-CP-2049) Avail: NTIS HC A10/MF A01 CSCL 13B

Methods of reducing the user hazards of nitrogen tetroxide, a hypergolic oxidizer are discussed. Kennedy Space Center developments in N2O4 control for the space shuttle are featured. Other areas covered are life support equipment and transportation. For individual titles, see N79-20425 through N79-20433.

N79-20425*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
A PORTABLE HYPERGOLIC OXIDIZER VAPOR SENSOR FOR NASA'S SPACE SHUTTLE PROGRAM c35
William R. Helms *In its* Proc. of the NASA/Fla. Inst. of Tech.

Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 1-10 refs (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 14B

The design and performance characteristics of an electrochemical NO2 sensor selected by NASA for the space shuttle program is described. The instrument consists of a sample pump, an electrochemical cell, and control and display electronics. The pump pushes the sample through the electrochemical cell where the vapors are analyzed and an output proportional to the NO2 concentration is produced. The output is displayed on a panel meter, and is also available at a recorder jack. The electrochemical cell is made up of a polypropylene chamber covered with teflon membrane faceplates. Plantinum electrodes are bonded to the faceplates, and the sensing and counter electrodes are potentiostatically controlled at -200 mV with respect to the reference electrode. The cell is filled with electrolyte, consisting of 13.5 cc of 23% solution of KOH. J.M.S.

N79-20426*# Directorate of Energy Management, Kelly AFB, Tex. Quality Div.
POTENTIAL OF A NITROGEN TETROXIDE SPILL OR EMISSION DURING MOVEMENT FROM SUPPLIER TO USER **c45**
Wilbur F. Watje *In* NASA. Kennedy Space Center Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 11-22 (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 13B

The type of equipment used to transport nitrogen tetroxide is described along with various methods of shipping utilized. Emphasis is placed on reduction of accident rate. Potential areas for leaks, emissions, or spills discussed include: accidental spills, transfer operations, sampling, and the so-called 'empty' trailer. Corrective actions taken to reduce the occurrence of these problems are briefly discussed. J.M.S.

N79-20427*# Florida Inst. of Tech., Melbourne. Medical Research Inst.
SCRUBBING LIQUORS FOR NITROGEN TETROXIDE **c45**
John J. Thomas *In* NASA. Kennedy Space Center Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 23-60 (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 13B

Once it was determined that the wet scrubbing concept was the most practical solution to the N2O4 emission problem, it became important to optimize the composition of the scrubbing liquor. Several reagents were cited in the literature as being advantageous in scrubbing NO2. Experiments were conducted on a model wet scrubber in order to verify and rank the performances of these scrubbing liquors. The most efficient scrubbing liquor found experimentally was a 10% sodium sulfite solution. J.M.S.

N79-20428*# Florida Inst. of Tech., Melbourne. Dept. of Mechanical Engineering.
ESTIMATED SHUTTLE LOADING EMISSIONS **c45**
Thomas E. Bowman *In* NASA. Kennedy Space Center Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 61-84 ref (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 13B

As space shuttle tanks are loaded with N2O4, pressurization gas is displaced and at the same time N2O4 entering the tank evaporates and mixes with the pressurization gas remaining in the tank. Further addition of N2O4 to the tank requires venting of this mixture of N2O4/NO2 vapor and pressurization gas, which must be scrubbed prior to atmospheric release. A computer analysis was performed to estimate concentrations, flow rates, and total quantities vented during the planned fast fill/slow fill cycles of 125 gallon and 640 gallon space shuttle tanks. With helium as the pressurization gas, total vent quantities were estimated to be 4.5 and 24 pounds N2O4, respectively, for the two tank sizes. Author

N79-20429*# Martin Marietta Corp., Denver, Colo. Engineering Propulsion Lab.
NITROGEN TETROXIDE VAPOR SCRUBBER USING A RECIRCULATING LIQUID **c45**
T. D. Reisert *In* NASA. Kennedy Space Center Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 85-110 ref (For primary document see N79-20424 11-42)
(Contract NAS10-9095)
Avail: NTIS HC A10/MF A01 CSCL 13B

Scrubbers required to reduce N2O4 contamination of nitrogen vent gas streams to a safe level to preclude health hazard to personnel and to preclude adverse environmental effects were developed. The scrubber principle involved is to absorb and neutralize the N2O4 component in a closed circuit circulating water/chemical solution in a vertical counter-flow, packed-tower configuration. The operational and performance test requirements for the scrubbers consist of demonstrating that the exit gas contamination level from the scrubbers does not exceed 150 ppm oxidizer under any flow conditions up to 400 scfm with inlet concentrations of up to 100,000 ppm oxidizer. Several problems were encountered during the performance testing that led to a series of investigations and supplementary testing. It was finally necessary to change the scrubber liquors in oxidizer scrubber to successfully achieve performance requirements. The scrubbers, the test configuration, and the various tests performed are described. J.M.S.

N79-20430*# Martin Marietta Corp., Denver, Colo. Mechanics Dept.
NITROGEN TETROXIDE SCRUBBER DATA ANALYSIS
Elvis D. Simon *In* NASA. Kennedy Space Center Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 111-130 refs (For primary document see N79-20424 11-42)
(Contract NAS10-9095)
Avail: NTIS HC A10/MF A01 CSCL 13B

A major difficulty in the analysis of scrubber data is that of separating the physical effects, such as mass transfer, from the physico-chemical effects, such as reaction rates. This is especially true for the absorbtion of nitrogen tetroxide in the various liquids that were tested in the NASA-Kennedy Space Center Hypergolic Toxic Scrubber Program. A fruitful approach to correlating the data for outlet concentrations was to treat the overall absorbtion as a pseudo first-order absorbtion equation. This approach provided a method for normalizing the data to constant inlet concentration, constant sump liquor condition, and constant scrubbing time, and permitted evaluation of the test and fluid parameters that affected both absorbtion rate and scrubbing time. The analysis indicated that scrubber performance may be improved by optimizing liquor concentrations and liquor flowrate distributions. Author

N79-20431*# Florida Inst. of Tech., Melbourne. Medical Research Inst.
ULTIMATE DISPOSAL OF SCRUBBER WASTES **c45**
Bernard C. Cohenour *In* NASA. Kennedy Space Center Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 131-158 (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 13B

Part of the initial concern with using the wet scrubbers on the hypergolic propellants was the subsequential disposal of the liquid wastes. To do this, consideration was given to all possible methods to reduce the volume of the wastes and stay within the guidelines established by the state and federal environmental protection agencies. One method that was proposed was the use of water hyacinths in disposal ponds to reduce the waste concentration in the effluent to less than EPA tolerable levels. This method was under consideration and even in use by private industry, municipal governments, and NASA for upgrading existing wastewater treatment facilities to a tertiary system. The use of water hyacinths in disposal ponds appears to be a very cost-effective method for reduction and disposal of hypergolic propellants. Author

N79-20432*# Planning Research Corp., Kennedy Space Center, Fla.
ADVANCED LIFE SUPPORT EQUIPMENT FOR NITROGEN TETROXIDE ENVIRONMENTS **c54**
George H. Bowman, III *In* NASA. Kennedy Space Center

Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 159-182 refs (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 06K

Design constraints considered in an effort to improve the self-contained atmospheric protection ensemble (SCAPE) are discussed. Emphasis is placed on overcoming the hazards of personnel engaged in orbiter crash/rescue operations. Specific topics covered include: suit material permeability; sealing of all suit penetration; and maintaining a positive pressure within the suit. J.M.S.

N79-20433*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DELTA NITROGEN TETROXIDE FUELING OPERATIONS
c14
R. B. Grigsby, T. M. Cross, and T. D. Rucci *In its* Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 183-196 (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 22D

The development of the Delta second stage nitrogen tetroxide fueling system is briefly summarized. The nitrogen tetroxide fueling system and the equipment used to protect the spacecraft environment from the toxic nitrogen tetroxide fumes are described. Topics covered include: the nitrogen tetroxide transfer system; loading operations; safety precautions; and chemical treatment of all toxic vapors. J.M.S.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N79-20434 California Inst. of Tech., Pasadena.
ANALYTICAL MODELLING OF OIL RECOVERY BY STEAM INJECTION Ph.D. Thesis
Yanis Christos Yortsos 1979 349 p
Avail: Univ. Microfilms Order No. 7904856

An extensive study of the heat transfer in the surroundings and the hot liquid zone is carried out to complement the one-dimensional implementation of the technique. The resulting class of moving boundary problems and their methods of solution are discussed in detail. The results obtained are then combined with the integral technique to derive upper and lower bounds, asymptotic solutions and approximate solutions to the rate of growth of the steam zone. The important physical parameters are identified and their significance in the design of the process is outlined. For two- (three-) dimensional systems, a more detailed version of the integral method is developed to account for the effect of gravity segregation in the determination of the steam front shape. A non-linear partial differential equation that described the evolution of the steam front shape in gravity dominated systems is derived. The significance of the various physical parameters in the performance of a three-dimensional steam injection process is discussed by providing a solution to the equation derived, in the limit of predominantly viscous flows. Dissert. Abstr.

N79-20435* National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 20
Jan. 1979 79 p
(NASA-SP-7041(20)) Avail: NTIS HC E02 CSCL 05B

This bibliography lists 273 reports, articles, and other documents introduced into the NASA scientific and technical information system between October 1 and December 31, 1978. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

N79-20436*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report, Dec. 1978 - Feb. 1979
Toby N. Carlson, Principal Investigator Mar. 1979 3 p Sponsored by NASA ERTS
(E79-10146; NASA-CR-158163) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N79-20437*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Oct. - Dec. 1978
Helen N. Paley and Anne B. Kahle, Principal Investigators Feb. 1979 14 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS7-100)
(E79-10160; NASA-CR-158050; HCM-028) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. The day infrared and visible HCMM satellite data for Death Valley taken on 31 May 1978 were compared with aircraft data of the same area taken in March of the same year. In the visible image, it is possible to note the drying of the valley floor during the two month period between acquisition of the two data sets. On the IR image however, the valley floor remains cool, probably indicating that while the standing water has disappeared, the floor is still moist.

N79-20438*# Houston Univ., Tex. Mathematics Dept.
SMALL GRAINS SEPARATION AND OPTIMAL PASS SELECTION Final Report, 14 Mar. - 30 Nov. 1978
H. P. Decell, Jr., Principal Investigator, B. C. Peters, W. A. Coberly, W. Tally, M. Malek, R. Basu, and J. Sparra 14 Jan. 1979 58 p refs EREP
(Contract NAS9-15543)
(E79-10167; NASA-CR-160116) Avail: NTIS HC A04/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-20439*# Humboldt State Univ., Arcata, Calif. School of Natural Resources.
THE APPLICATION OF REMOTE SENSING TECHNOLOGY IN NORTHERN CALIFORNIA Semiannual Progress Report, Oct. 1978 - Mar. 1979
Lawrence Fox, III, Principal Investigator 1979 43 p ERTS
(Grant NsG-2341)
(E79-10168; NASA-CR-158164) Avail: NTIS HC A03/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N79-20440*# Pan American Univ., Edinburg, Tex.
EXPERIMENTAL AND THEORETICAL TESTS OF A MODIFIED SUITS MODEL Final Report, 1 Oct. 1977 - 30 Sep. 1978
E. W. LeMaster and J. E. Chance, Principal Investigators Feb. 1979 35 p refs ERTS
(Grant NsG-9033)
(E79-10169; NASA-CR-158165) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-idenified significant results in this report.

N79-20441*# South Dakota State Univ., Brookings. Remote Sensing Inst.
REMOTE SENSING APPLICATIONS TO RESOURCE PROBLEMS IN SOUTH DAKOTA Semiannual Progress Report, 1 Jul. - 31 Dec. 1978
Victor I. Myers, Principal Investigator 31 Dec. 1978 91 p refs Original contains color imagery. Original photography may

be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-42-003-007)
(E79-10170; NASA-CR-158166; SDSU-RSI-78-26) Avail: NTIS HC A05/MF A01 CSCL 08F
There are no author-identified significant results in this report.

N79-20442*# Georgia Inst. of Tech., Atlanta.
COMPUTER PROCESSING OF PEACH TREE DECLINE DATA Final Report
N. L. Faust, Principal Investigator, M. D. Furman, and G. W. Spann (Metrics, Inc.) 12 Dec. 1978 56 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS8-31850)
(E79-10171; NASA-CR-161160) Avail: NTIS HC A04/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N79-20443*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
ACCURACY ASSESSMENT DISK DATA BASE DEVELOPMENT FOR LACIE. PHASE 3: USER'S INFORMATION
J. G. Carnes, Principal Investigator and J. E. Hartman Dec. 1978 27 p ref Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15200)
(E79-10172; NASA-CR-160109; JSC-14626; LEC-13003) Avail: NTIS HC A03/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N79-20444*# Department of Agriculture, Weslaco, Tex. Science and Education Administration.
PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Dec. 1978 - 1 Mar. 1979
Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Mar. 1979 5 p ERTS
(NASA Order S-40198B)
(E79-10173; NASA-CR-158170) Avail: NTIS HC A02/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N79-20445*# National Oceanic and Atmospheric Administration, Washington, D. C.
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES
Donald R. Wiesnet, Principal Investigator, David F. Mcginnis, and Michael Matson 21 Mar. 1979 3 p Sponsored by NASA ERTS
(E79-10174; NASA-CR-158175; QR-6) Avail: NTIS HC A02/MF A01 CSCL 08C
There are no author-identified significant results in this report.

N79-20446*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM Quarterly Report, 1 Jul. - 30 Sep. 1978
R. P. Mroczynski, Principal Investigator 30 Sep. 1978 53 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-15325)
(E79-10175; NASA-CR-160118; LARS-093078) Avail: NTIS HC A04/MF A01 CSCL 02F
The author has identified the following significant results. A benchmark classification evaluation framework was implemented. The FRIS preprocessing activities were refined. Potential geo-based referencing systems were identified as components of FRIS.

N79-20447*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AGGREGATION OF LARGE AREA CROP INVENTORY EXPERIMENT (LACIE) TRANSITION YEAR DATA USING LACIE PHASE 3 SOFTWARE
C. J. Liszca, Principal Investigator Jan. 1979 14 p Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15200)
(E79-10176; NASA-CR-160120; JSC-14670; LEC-12686) Avail: NTIS HC A02/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N79-20448*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
REGRESSIONS BY LEAPS AND BOUNDS AND BIASED ESTIMATION TECHNIQUES IN YIELD MODELING
N. Marquina, Principal Investigator Feb. 1979 81 p refs EREP
(Contract NAS9-15800)
(E79-10177; NASA-CR-160133; LEC-12379; JSC-12700) Avail: NTIS HC A05/MF A01 CSCL 12A
The author has identified the following significant results. It was observed that OLS was not adequate as an estimation procedure when the independent or regressor variables were involved in multicollinearities. This was shown to cause the presence of small eigenvalues of the extended correlation matrix A'A. It was demonstrated that the biased estimation techniques and the all-possible subset regression could help in finding a suitable model for predicting yield. Latent root regression was an excellent tool that found how many predictive and nonpredictive multicollinearities there were.

N79-20449*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DIGITAL PROCESSING OF LANDSAT MSS AND TOPOGRAPHIC DATA TO IMPROVE CAPABILITIES FOR COMPUTERIZED MAPPING OF FOREST COVER TYPES Quarterly Progress Report, 16 Dec. 1977 - 15 Mar. 1978
Roger M. Hoffer, Principal Investigator Mar. 1978 15 p refs EREP
(Contract NAS9-15508)
(E79-10178; NASA-CR-160122) Avail: NTIS HC A02/MF A01 CSCL 02F
There are no author-identified significant results in this report.

N79-20450*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DIGITAL PROCESSING OF LANDSAT MSS AND TOPOGRAPHIC DATA TO IMPROVE CAPABILITIES FOR COMPUTERIZED MAPPING OF FOREST COVER TYPES Quarterly Progress Report, 16 Mar. - 15 Jun. 1978
Roger M. Hoffer, Principal Investigator Jun. 1978 18 p EREP
(Contract NAS9-15508)
(E79-10179; NASA-CR-160123) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N79-20451*# Lockheed Electronics Co., Houston, Tex.
AN EVALUATION OF NATURAL STRATIFICATION AND SAMPLE ALLOCATION USED IN TRANSITION YEAR FOR THE US GREAT PLAINS
R. S. Chhikara, Principal Investigator Jan. 1979 39 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E79-10180; NASA-CR-160132; JSC-15800; LEC-13079) Avail: NTIS HC A03/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N79-20452*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NATIONWIDE FORESTRY APPLICATIONS PROGRAM. TEN-ECOSYSTEM STUDY (TES) SITE 6, FORT YUKON, ALASKA Final Report

J. F. Ward, Principal Investigator and B. F. Edwards Dec. 1978 87 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-15200)
(E79-10181; NASA-CR-160131; LEC-12567; JSC-12693) Avail: NTIS HC A05/MF A01 CSCL 08F

The author has identified the following significant results. Analysis of the processing results has led to the following conclusions: (1) LANDSAT imagery was a reliable resource for the stratification of level 2 forest features (softwood, hardwood, tundra, and water). These features can be classified with an accuracy of 72.4 percent + or - 5.9 percent at the 90 percent confidence level. (2) Training fields selected for signature development from only 10 percent of the area did not adequately and efficiently cover the class variability for the entire area. (3) Derived regression transformations were ineffective in recovering the loss of level 1 forest proportions and level 2 softwood and hardwood proportions.

N79-20453*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NATIONWIDE FORESTRY APPLICATIONS PROGRAM. TEN-ECOSYSTEM STUDY (TES) SITE 7, WELD COUNTY, COLORADO Final Report
J. E. Weaver, Principal Investigator and R. H. Almond Jan. 1979 51 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-15800)
(E79-10182; NASA-CR-160126; LEC-12921; JSC-14671) Avail: NTIS HC A04/MF A01 CSCL 08F

The author has identified the following significant results. The best dates for automatic data processing analysis appeared to be in midsummer. The level 2 separation of grassland, water, and other resources was reasonably successful, but the level 3 separation of grassland into cultivated (growing crops) and weeds did not appear feasible. Low simulated inventory proportions of grassland indicated that the restricted inventory signature was not representative of all grassland classes and could not be extended with acceptable accuracy.

N79-20454*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DIGITAL PROCESSING OF LANDSAT MSS AND TOPOGRAPHIC DATA TO IMPROVE CAPABILITIES FOR COMPUTERIZED MAPPING OF FOREST COVER TYPES Quarterly Progress Report, 16 Jun. - 15 Sep. 1978
Roger M. Hoffer, Principal Investigator Sep. 1978 29 p refs EREP
(Contract NAS9-15508)
(E79-10183; NASA-CR-160124) Avail: NTIS HC A03/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N79-20455*# National Aeronautics and Space Administration. Earth Resources Lab., Slidell, La.
THE NATURAL RESOURCES INVENTORY SYSTEM ASVT PROJECT Final Report
Armond T. Joyce Jan. 1979 129 p refs
(NASA-TM-58211) Avail: NTIS HC A07/MF A01 CSCL 08F

The hardware/software and the associated procedures for a natural resource inventory and information system based on the use of LANDSAT-acquired multispectral scanner digital data is described. The system is designed to derive land cover/vegetation information from LANDSAT data and geographically reference this information for the production of various types of maps and for the compilation of acreage by land cover/vegetation category. The system also provides for data base building so that the LANDSAT-derived information can be related to information digitized from other sources (e.g., soils maps) in a geographic context in order to address specific applications. These applications include agricultural crop production estimation, erosion hazard-reforestation need assessment, whitetail deer habitat assessment, and site selection. The system is tested in demonstration areas located in the state of Mississippi, and the results of these application demonstrations are presented. A cost-efficiency comparison of producing land cover/vegetation maps and statistics with this system versus the use of small-scale aerial photography is made. Author

N79-20456*# National Aeronautics and Space Administration, Washington, D. C.
PILOT INTERMINISTERIAL OPERATION FOR REMOTE SENSING
J. M. deLamare, M. Bied-Charreton, A. Couzy, A. Jahan, J. Ledder, and J. Pasquet Mar. 1979 43 p Transl. into ENGLISH of "L'Operation Pilot Interiministerielle de Teledetection", Paris, 1978 25 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75609) Avail: NTIS HC A03/MF A01 CSCL 05B

Advantages and disadvantages of traditional methods of obtaining required information for land and resources management and the possibilities of remote sensing are discussed. The services available, organization and objectives of the pilot operation are presented. Emphasis is placed on multidisciplinary dialog among designers, builders, operators, interpreters and users in all phases. The principles, operation and practical applications of remote sensing systems and processing systems under the pilot operation are presented. Author

N79-20457# Royal Aircraft Establishment, Farnborough (England).
VISUAL ERGONOMICS IN CARTOGRAPHIC AND LITHOGRAPHIC WORK AT THE TOPOGRAPHIC SERVICE. PART 1: OPTOMETRIC ASPECTS AND VISUAL REQUIREMENTS
J. Boogaard, K. A. deVries, E. Ellens, and H. J. Leebeek Sep. 1978 25 p refs Transl. into ENGLISH of "Visuele Ergonomie Bij Kartografische en Lithografische Werkzaamheden op de Topografische Dienst. Deel 1: Optometrische Aspekten en Visuele Eisen", Rept-1978-14 Inst. voor Zintuigfysiologie, Holland, 1978
(RAE-Lib-Trans-1988; BR67113-Pt-1) Avail: NTIS HC A02/MF A01

Job-related complaints of cartographic draftsmen were connected with the fact that almost continuously small map details had to be examined at very short distances. The job situation could be improved by providing the cartographers and lithographers with special working glasses. Furthermore, visual standards were formulated to be used when applicants for jobs are examined medically or in the case of re-examination of cartographic co-operators. A.R.H.

N79-20458# Los Alamos Scientific Lab., N. Mex.
TOWARD ASSESSING THE GEOTHERMAL POTENTIAL OF THE JEMEZ MOUNTAINS VOLCANIC COMPLEX: A TELLURIC-MAGNETOTELLURIC SURVEY
John F. Hermance (Brown Univ.) Feb. 1979 88 p refs
(Contract W-7405-eng-36)
(LA-7656-MS) Avail: NTIS HC A05/MF A01

Telluric-magnetotelluric studies were performed in the Jemez Mountains of north-central New Mexico to characterize the total geothermal system of the Valles Caldera and to be integrated with an east-west regional survey supported by the United States Geological Survey. The data from the regional survey indicate that electrically the San Juan Basin to the west of the Jemez Mountains is rather homogeneous in contrast to the eastern side near Las Vegas where the presence of a broad heterogeneous structure is clearly sensed. The data from the Jemez Mountain area are strikingly similar to other Rio Grande rift data and suggest a conducting layer at a depth of approximately 15 km. The telluric data indicate that the hydrothermal system in the area is of a localized nature. Author

N79-20459# Colorado School of Mines, Golden. Dept. of Geophysics.
RESEARCH ON THE PHYSICAL PROPERTIES OF GEOTHERMAL RESERVOIR ROCK Quarterly Report
C. K. Skokan and A. Ibrahim Jul. 1978 65 p refs
(Contract EY-76-S-02-2908)
(COO-2908-4) Avail: NTIS HC A04/MF A01

Laboratory measurements of thermal conductivity and capillary pressure undertaken for samples of Cenozoic Volcanic rocks collected from the Columbia Plateau Volcanic basin are presented.

These measurements were performed at atmospheric pressure and room temperature. Various methods of measuring thermal conductivity were investigated and finally a flash method was chosen. The equipment was constructed and tested. Numerous capillary pressure curves were obtained by use of the mercury injection technique. These curves indicate pore structure: pore size, pore distribution, pore volume, and pore geometry. Measurements of this type help to explain variations in rock properties such as seismic velocities and resistivities. J.M.S.

N79-20460# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

PHOTOMETRIC STEREO

Robert J. Woodham Jun. 1978 22 p refs

(Contracts N00014-75-C-0643; N00014-77-C-0389)

(AD-A062379; AI-M-479) Avail: NTIS HC A02/MF A01 CSCL 14/5

Traditional stereo techniques determine range by relating two images of an object viewed from different directions. If the correspondence between picture elements is known, then distance to the object can be calculated by triangulation. Unfortunately, it is difficult to determine this correspondence. This paper introduces a novel technique called photometric stereo. The idea of photometric stereo is to vary the direction of the incident illumination between successive views while holding the viewing direction constant. This provides enough information to determine surface orientation at each picture element. Since the imaging geometry does not change, the correspondence between picture elements is known a priori. This stereo technique is photometric because it uses the intensity values recorded in a single picture element, in successive views, rather than the relative positions of features. Author (GRA)

N79-20461# Naval Oceanographic Office, NSTL Station, Miss.

REGIONAL GEOLOGICAL MAPS OF THE NORTHEAST PACIFIC: STANDARD NAVY OCEAN AREA NP-9 Final Report

William T. Morton and Allen Lowrie 1978 50 p refs

(AD-A062095; NOO-RP-16) Avail: NTIS HC A03/MF A01 CSCL 08/10

Eleven geophysical and geological maps have been compiled for the central northeast Pacific. These maps are based upon bathymetric, magnetic, seismic reflection, and core sample data from all available sources, and contain an estimated 90 percent of the existing data. Comparison of the maps for the region shows that basement structure controls topography, except near the continental margins where alluvial fans have the dominant influence. Continental margin and abyssal plain deposits flank the actively spreading Gorda and Juan de Fuca Ridges. Interpretations have been deliberately limited so that emphasis could be placed on the criteria used for evaluating data and compiling maps. References have been cited in sufficient number to provide a general reading guide for further study. Author (GRA)

N79-20462# RCA Advanced Technology Labs., Camden, N. J.

SCANNING CURSOR DEVICE Final Technical Report, Oct. 1976 - Sep. 1977

G. W. Hunka and L. C. Conant, Jr. Oct. 1978 63 p

(Contract F30602-76-C-0443)

(AD-A062552; RADC-TR-78-211) Avail: NTIS HC A04/MF A01 CSCL 09/2

A developmental model of an aided-track digitizing cursor used in conjunction with a digitizing table is described; this cursor can significantly increase the efficiency of digitizing graphic materials. The cursor incorporates a rotatable linear photodiode array onto which the feature being digitized is imaged. Processing of the array output produces a count indication of the deviation of the feature from the table encoder fiducial marking. A dedicated minicomputer is used to combine the digitizing encoder outputs with the array correctional counts to derive accurate coordinate values in the presence of tracking errors up to 1/16th inch. Rotational commands are generated by the computer to orient the array perpendicular to the traced feature for maintaining accuracy in cases where curvatures exist in the traced function. Rotation through - or - 360 degrees permits closed contours to be traced with no sacrifice in encoding accuracy. Preliminary tests have shown correctional accuracies of better than - or - 4 mils can be achieved with the system, equaling the resolution accuracy of the digitizing table. Algorithms and software developed for this device allow compatible operation with the Lineal Input System (LIS) used in generating cartographic materials. The LIS System was developed by the Experimental Cartographic Facility, RADC, Griffiss Air Force Base, N. Y. Author (GRA)

N79-20463# Lundy Electronics and Systems, Inc., Glen Head, N. Y.

DIGITAL DATA EDITING SYSTEM Final Report, 26 Feb. 1976 - 25 Feb. 1977

William E. Handler Sep. 1977 28 p refs

(Contract DAAG53-76-C-0095)

(AD-A062551; ETL-0148) Avail: NTIS HC A03/MF A01 CSCL 09/2

A requirement within a computerized map and chart production process is editing of the digitized data prior to the final copy. This paper describes an off-line editing subsystem of the semi-automated cartography system developed by the U.S. Army Engineer Topographic Laboratory (USAETL) at Fort Belvoir and the Defense Mapping Agency (DMA) production centers. Author (GRA)

N79-20464# Ohio State Univ., Columbus. Dept. of Geodetic Science.

APPROXIMATION OF COVARIANCE FUNCTIONS BY NON-POSITIVE DEFINITE FUNCTIONS

Hans Suenkel May 1978 90 p

(Contract F19628-76-C-0010)

(AD-A062468; DGS-271; SCIENTIFIC-15; AFGL-TR-78-0177)

Avail: NTIS HC A05/MF A01 CSCL 08/5

In some applications of collocation two serious drawbacks were faced: frequent calculations of linear functionals operating on the covariance function, and the inversion of a large matrix, both causing much computer time. The frame of this work is an investigation on how to avoid calculations of the exact covariance function and to replace it by some approximations. Three different kinds of approximating functions are studied, all of them being finite elements: the step function, the piecewise linear function and the cubic spline function. After stating the essential properties of covariance functions, its approximations are discussed for the distance dependent covariance function and its extension into space. Author (GRA)

N79-20465# Raytheon Co., Wayland, Mass. Equipment Div.

THE EFFECTS OF PHOTO CHARACTERISTICS UPON LOCATION DETERMINATION IN A PHOTOGRAMMETRIC FACILITY Final Report, 28 Dec. 1972 - 27 Dec. 1973

E. Sewell, A. Harabedian, and T. E. Jeffrey Oct. 1978 63 p

(Contract DAHC19-73-C-0031)

(AD-A062255; FR73-1490; ARI-TR-346) Avail: NTIS HC A04/MF A01 CSCL 14/5

The operator of the Army Analytical Photogrammetric Positioning System (APPS) must perform a critical step in the coordinate determination procedure by the subjective comparison of dissimilar images. He must correlate reconnaissance mission imagery with aerotriangulated photographic stereoscopic pairs, known as data base imagery, and visually identify the image position on the data base of a target detected on the mission image. Results obtained from 40 image interpreters performing this task using vertical, oblique, and panoramic mission imagery are given. Two levels of target position difficulty were established: (1) A-points located at terrain or man-made features mutually identifiable on both mission and data base imagery; (2) B-points remote from terrain or man-made features mutually identifiable on mission and data base imagery. Transfer of A-points for vertical, oblique, and panoramic photographs was accomplished with good accuracy--median location error was 19 meters or less. Performance was significantly better when A-points in panoramic missions were located in the near-vertical half of the image in contrast to the near-horizon half. Transfer of B-points was more difficult. For vertical missions, median location error was about 20 meters. For oblique or panoramic imagery, location errors were markedly greater when the B-points were located in the horizon half of the image as compared to performance when the points were in the near-vertical half of the image. GRA

N79-20466*# Geological Survey, Reston, Va.
US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: OLYMPIC NATIONAL PARK Man and the Biosphere Program
Janet M. Bonner, comp. 1978 84 p refs Sponsored by NASA
(NASA-CR-158404; PB-288840/2) Avail: NTIS HC A05/MF A01 CSCL 08B

The photographs and images of the Olympic National Park and adjacent area available from the USGS are listed. The list includes: (1) LANDSAT 1 and 2; (2) NASA aircraft photography; and (3) USGS mapping photography. J.M.S.

N79-20467*# Geological Survey, Reston, Va.
US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: GREAT SMOKY MOUNTAINS NATIONAL PARK Man and the Biosphere Program
Janet M. Bonner, comp. 1978 82 p refs Sponsored by NASA
(NASA-CR-158405; PB-288841/0) Avail: NTIS HC A05/MF A01 CSCL 08B

Photographs and images of the Great Smoky Mountains National Park and adjacent areas available from the USGS are listed. The list includes: (1) LANDSAT 1 and 2 (formerly ERTS), 1972 to 1978; (2) Skylab, 1973 to 1974; (3) NASA aircraft photography, 1969 to 1973; (4) USGS mapping photography, 1956 to 1975. GRA

N79-20468*# Geological Survey, Reston, Va.
US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: GLACIER NATIONAL PARK Man and the Biosphere Program
Janet M. Bonner, comp. 1978 83 p refs Sponsored by NASA
(NASA-CR-158402; PB-289576/1) Avail: NTIS HC A05/MF A01 CSCL 08B

Photographs and images of biosphere reserves taken from spacecraft and aircraft provide a significant data base showing broad views and details of the landscape and are invaluable in searching for changes and trends in forest cover, water area, and other diagnostic landscape features. Each data report in this series lists remotely sensed data gathered from spacecraft and aircraft available for a single biosphere reserve. Computer listings of data are provided by the EROS Data Center of the U. S. Geological Survey, which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

N79-20469# Arizona State Univ., Tempe. Dept. of Chemical Engineering.
DEVELOPMENT AND EVALUATION OF IMPROVED FILMS FOR SUPPRESSIVE WATER EVAPORATION
C. O. Reiser and T. J. Ruhoff Jul. 1978 20 p refs
(Contract DI-14-31-0001-5003)
(PB-289230/5; W79-01537; OWRT-A-061-ARIZ(1)) Avail: NTIS HC A02/MF A01 CSCL 13B

A small water-wind tunnel with an air passage 0.24 m high by 0.22 m wide and 6.5 m long over a water layer 7 cm deep was used for the dynamic testing of surface films for evaporation control. Differences in the entering and exit humidity were determined at air speeds up to 11 m/sec when feeding water suspensions of resistant films at the tunnel entrance. At the conditions used, long-chain alcohol films with 16 to 20 carbons mixed with 10% of a C18 monoethoxylate gave about 50% evaporation reduction and were about twice as effective as multilayer films containing linoleic acid polymerized with polyvinyl alcohol. Wave dampening above 11 m/sec (24.5 mi/hr) is difficult and no significant difference in wave suppression was observed between these two types. GRA

N79-20470# Montana State Univ., Bozeman. Water Resources Research Center.
MONTANA'S WATER RESOURCES: A RESEARCH TRUST
Mar. 1978 39 p Prepared in cooperation with Montana Coll. of Mineral Sci. and Technol., Butte, and Montana Univ., Missoula
(Contract DI-14-34-0001-7055)
(PB-289227/1; W79-01541; OWRT-A-999-MONT(2)) Avail: NTIS HC A03/MF A01 CSCL 13B

The 1975-77 programs of the Center provided funding/administration for twenty allotment, three matching grant, two Title II, and three regional cooperative projects. The projects, which deal with such diverse topics as water quality; economic, social, and institutional studies; mining impacts; saline seep; water resources; land use; wastewater treatment; irrigation effects; and soils-water relationships, are described briefly. Research results have contributed to the control of saline seep, maintaining and improving water quality, analysis and discussion of economic and social issues related to coal-water-energy development in the Yellowstone River Basin, and conservation of precipitation (snow). GRA

N79-20471# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
SEASONAL DISTRIBUTION, TRAJECTORY STUDIES AND SORPTION CHARACTERISTICS OF SUSPENDED PARTICULATE MATTER IN THE NORTHERN PUGET SOUND REGION
Edward T. Baker, Joel D. Cline, Richard A. Feely, and Joyce Quan Jul. 1978 156 p refs Sponsored in part by EPA
(PB-288791/7; EPA-600/7-78-126) Avail: NTIS HC A08/MF A01 CSCL 08H

The spatial and seasonal distributions of suspended particulate matter and its adsorption characteristics relative to Alaskan crude oils were studied. Seasonal distributions of total suspended solids were determined for the area north of Admiralty Inlet, east of Port Angeles, and south of the Fraser River between November 1976 and August 1977. The LANDSAT images were utilized to study surface trajectories of sediment plumes originating from the Fraser and Skagit Rivers. The composition and abundance of hydrocarbons associated with suspended matter was evaluated at five strategic locations in the northern Puget Sound region. Laboratory measurements were performed under simulated natural conditions to investigate the short-term interaction between Prudhoe Bay crude oil and two locally-derived riverine sediments. GRA

N79-20472# Geological Survey, Tucson, Ariz. Water Resources Div.
METHODS FOR ESTIMATING THE MAGNITUDE AND FREQUENCY OF FLOODS IN ARIZONA Final Report, 1962 - 1978
R. H. Roeske Sep. 1978 91 p refs Sponsored by DOT
(PB-289424/4; ADOT/RS-15(121)-F; FHWA-AZ-78-121) Avail: NTIS HC A05/MF A01 CSCL 08H

Regression equations from estimating flood magnitudes at ungaged sites for recurrence intervals of 2, 5, 10, 25, 50, 100 and 500 years were developed for six flood-frequency regions. The equations relate flood magnitudes to one or more of the following statistically independent variables: size of drainage area, mean basin elevation, and mean annual precipitation. The regression equations are based on annual peak-discharge data collected at 221 gaging stations having 10 or more years of record. Flood magnitudes for selected recurrence intervals were determined for each station from a log-Pearson Type 3 frequency distribution, and multiple-regression analyses were used to relate flood magnitudes to basin characteristics. GRA

N79-20473# Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
COMPUTING EVAPORATION FOR INLAND WATER BODIES UNDER A VARIETY OF FETCH AND ATMOSPHERIC STABILITY CONDITIONS
S. L. Taylor and D. R. DeWalle Nov. 1978 76 p refs
(Contract DI-14-34-0001-7128)
(PB-289372/5; W79-01895; OWRT-B-094-PA(1)) Avail: NTIS HC A05/MF A01 CSCL 08H

A term representing free convection, forced convection and the interaction of forced and free convection is contained in the equation. Data sets from lake and cooling pond evaporation were used to derive empirical coefficients and initially test the equation.

The equations were compared using data from a thermally-loaded reach of the West Branch Susquehanna River in Pennsylvania. Evaporation predictions using both the proposed equations proved to be more accurate over a wider range of thermal loading and fetch length conditions. GRA

N79-20474# Alaska Univ., Fairbanks. Inst. of Water Resources.
FLOOD FREQUENCY DESIGN IN SPARSE-DATA REGIONS
Robert F. Carlson and Patricia M. Fox Jun. 1978 16 p refs
(Contract DI-14-31-0001-5217)
(PB-289389/9; IWR-94; W79-01901; OWRT-B-030-ALAS(2)) Avail: NTIS HC A02/MF A01 CSCL 13B

This project was directed towards improved techniques for flood capacity design in areas of extremely sparse data such as cold regions. The work included development of the appropriate risk selection with Bayesian analysis techniques. As most flood determination procedure involves some type of model calculation, a portion of the work was aimed towards an appropriate model choosing technique. Several techniques were developed to describe the channel dynamics of northern braided rivers with particular emphasis on scour phenomenon and engineering structures. A field review of existing hydraulic engineering design performance examined bridge, culvert, and pipeline crossings along the Alaska oil pipeline route from Fairbanks to Prudhoe Bay. GRA

N79-20475# Cornell Univ., Ithaca, N. Y. Center for Environmental Research.
REMOTE SENSING ASSESSMENT OF DAM FLOODING HAZARDS: METHODOLOGY DEVELOPMENT FOR THE NEW YORK STATE DAM SAFETY PROGRAM
J. P. Berger, W. R. Philipson, and T. Liang Nov. 1978 63 p refs
(Contract DI-14-34-0001-8034)
(PB-289371/7; W79-01980; OWRT-A-081-NY(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

A methodology was developed to increase the efficiency and accuracy of dam inspection in New York State by incorporating remote sensing techniques into the State Dam Safety Program. The methodology placed emphasis on readily available remotely sensed data-aerial photographs and LANDSAT data. Aerial photographs were employed in establishing a statewide data base referenced on county highway and U.S. Geological Survey 1:24,000 scale, topographic maps. Data base updates were conducted by region or county, using LANDSAT or aerial photographs as a primary source of information. Field investigations were generally limited to high-hazard or special problem dams. GRA

N79-20476# Missouri Univ. - Columbia. Dept. of Geology.
GEOCHEMISTRY OF GROUND WATER, SOUTHWESTERN MISSOURI M.S. Thesis
James M. Darr May 1978 121 p refs
(Contract DI-14-34-0001-6026; OWRT Proj. A-086-MO(2))
(PB-289231/3; W79-01535) Avail: NTIS HC A06/MF A01 CSCL 13B

Geochemical and microbiological characteristics of the groundwater were investigated in relation to problems involving invasion of aquifers by brackish water. Mineralogy of Pennsylvanian sandstones and limestones was determined by standard methods. Water samples were obtained from 70 farm and municipal water supply wells. Analysis of the groundwater data revealed the presence of a northwest-southeast trending salinity gradient, with water in northwest and central parts of the area unsuitable for human consumption. Bacteriological analysis detected sulfate reducing bacteria. Mineral studies showed that water is in equilibrium with calcite and dolomite and suggest that the presence of ferrous iron enhances stability of dolomite relative to calcite. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N79-20477 Tulsa Univ., Okla.
EXPERIMENTAL INVESTIGATION OF THE KINETICS OF UNDERGROUND DRY, FORWARD COMBUSTION Ph.D. Thesis
Omar Allag 1978 125 p
Avail: Univ. Microfilms Order No. 7905544

An experimental investigation was done of dry, forward combustion with two main objectives, viz., (1) to develop a method for determining the kinetic parameters of fuel laydown and burnoff from combustion tube data, and (2) to evaluate them for a particular crude-sand mixture. In the light, it was found that operating pressure has essentially no effect on the exponential energy, but it does affect the pre-exponential (or frequency) factor. Also the essential phenomena of forward combustion can be adequately depicted by the two-step chain reaction concept, and that kinetic data, or their bounds, can be determined from combustion tube data. Dissert. Abstr.

N79-20478*# Alabama Univ. in Huntsville. Kenneth E. Johnson Environmental and Energy Center.
COST ANALYSIS AND OPTIMIZATION STUDY FOR SOLAR HEATING AND COOLING SYSTEMS, STILLWATER, MINNESOTA AND NEWCASTLE, PENNSYLVANIA
William L. Reid Nov. 1978 90 p
(Contract NAS8-31293)
(NASA-CR-161201) Avail: NTIS HC A05/MF A01 CSCL 10A

A detailed cost analysis study of two solar energy systems was performed, in order to derive specific quantified and potential cost savings, design refinements, and/or design innovations for each of the selected solar energy systems represented by selected operational test sites. Preliminary cost estimates are given for liquid type systems based on the second series of operational test sites studied: Stillwater, Minnesota and New Castle, Pennsylvania. J.M.S.

N79-20479*# Springborn Labs., Inc., Enfield, Conn.
INVESTIGATION OF TEST METHODS, MATERIAL PROPERTIES, AND PROCESSES FOR SOLAR CELL ENCAPSULENTS Quarterly Progress Report, 12 Aug. - 12 Nov. 1978
Dec. 1978 33 p Sponsored by NASA Prepared for DOE and JPL
(Contract JPL-954527; Proj. 6072.1)
(NASA-CR-158369; DOE/JPL-954527-78/8; QPR-10) Avail: NTIS HC A03/MF A01 CSCL 10A

The technical activities were directed toward the assessment of encapsulation processes for use with ethylene/vinyl acetate copolymer as the pottant. Potentially successful formulations were prepared by compounding the raw polymer with ultraviolet absorbers and crosslinking agents to give stabilized and curable compositions. The compounded resin was then converted to a more useful form with an extruder to give pottant in sheets that could be more easily used in lamination. After experimenting with various techniques, the vacuum-bag process was found to be an excellent encapsulation method. Miniature single-celled and multi-celled solar modules of both substrate and superstrate designs were prepared by this technique. The resulting modules were of good appearance, were bubble-free, and successfully passed the thermal cycle test. L.S.

N79-20480*# RCA Labs., Princeton, N. J.
AUTOMATED ARRAY ASSEMBLY, PHASE 2 Quarterly Report, 1 Jul. - 30 Sep. 1978
R. V. Daiello Oct. 1978 42 p refs Sponsored in part by DOE

(Contracts NAS7-100; JPL-954868)
(NASA-CR-158360; DOE/JPL-954868-78/4; QR-4) Avail: NTIS HC A03/MF A01 CSCL 10A

The purpose of the overall program is to establish technological readiness and provide verification for the elements of a manufacturing sequence which would ultimately be suitable for the large-scale production of silicon solar-array modules at a selling price of less than $500/kW. A program and process plan for accomplishing this objective was developed and put into operation. Three junction-formation processes are shown; since cost analysis shows that they do not differ greatly in cost, each should be considered for technical merits and possible future cost reduction. The progress made in the various process steps of the plan is described, and conclusions are presented. L.S.

N79-20481*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
AUTOMATED ARRAY ASSEMBLY, PHASE 2. LOW-COST SOLAR ARRAY PROJECT, TASK 4 Final Report
Mike Lopez Oct. 1978 112 p refs Sponsored by DOE
(Contract JPL-954898)
(NASA-CR-158365; LMSC-D632522; DOE/JPL-954898-78/4) Avail: NTIS HC A06/MF A01 CSCL 10A

Work was done to verify the technological readiness of a select process sequence with respect to satisfying the Low Cost Solar Array Project objectives of meeting the designated goals of $.50 per peak watt in 1986 (1975 dollars). The sequence examined consisted of: (1) 3 inches diameter as-sawn Czochralski grown 1:0:0 silicon, (2) texture etching, (3) ion implanting, (4) laser annealing, (5) screen printing of ohmic contacts and (6) sprayed anti-reflective coatings. High volume production projections were made on the selected process sequence. Automated processing and movement of hardware at high rates were conceptualized to satisfy the PROJECT's 500 MW/yr capability. A production plan was formulated with flow diagrams integrating the various processes in the cell fabrication sequence. L.S.

N79-20482*# Schumacher (J. C.) Co., Oceanside, Calif.
THE PRODUCTION OF SOLAR CELL GRADE SILICON FROM BROMOSILANES Final Report
J. C. Schumacher, L. Woerner, E. Moore, and C. Newman Jan. 1979 70 p refs Sponsored in part by DOE
(Contract JPL-954914)
(NASA-CR-158362; SE-655; DOE/JPL-954914-78/2) Avail: NTIS HC A04/MF A01 CSCL 10A

A continuous Flow Reactor (CFR) process based on the hydrogen reduction of the bromosilanes SiBr4 and SiHBr3 was proposed. Initial experiments carried and directed at obtaining overall yield data for bromosilane reduction in the CFR, indicated the need for increased reactor residence time and deposition substrate particle packing density to fully characterize the kinetics (rate) and thermodynamics (yield) of observed silicon production. Fluidized bed experiments were therefore initiated to overcome these experimental difficulties, which showed both thermal decomposition and hydrogen reduction of SiHBr3 in a fluid bed reactor to present attractive closed-loop processes for producing solar cell grade polycrystalline silicon. No process selection could be made however due to the fact that preliminary optimization of 2 of 3 process stages in each case during the course of the experimental program showed comparable attainment of cost element objectives. J.M.S.

N79-20483*# Mobil Tyco Solar Energy Corp., Waltham, Mass.
LARGE AREA SILICON SHEET BY EFG Annual Progress Report, 1 Oct. 1977 - 30 Sep. 1978
F. V. Wald 16 Feb. 1979 79 p refs Prepared for JPL
(Contract JPL-954355)
(NASA-CR-158379; DOE/JPL-954355-78/3) Avail: NTIS HC A05/MF A01 CSCL 10A

Progress made in the development of EFG ribbon growth is discussed. Specific areas covered include: (1) demonstration of multiple growth for ribbons 5 cm wide in runs of 12 and 20 hours duration; (2) a single cartridge crystal growth station was built expanding observational capacity by virtue of an anamorphic optical-video system which allows close observation of the meniscus over 7.5 cm wide, as well as video taping of the ribbon growth process; (3) growth station no. 1 achieved reproducible and reliable growth of 7.5 cm wide ribbon at speeds up to 4 cm/min; (4) introdution of the 'mini cold shoe'; (5) increases in cell efficiency due to interface shaping using the 'displaced die' concept; and (6) clarification of the role of gaseous impurities in cartridge furnaces and stabilization of their destabilizing influence on growth. J.M.S.

N79-20484*# Westinghouse Research and Development Center, Pittsburgh, Pa.
PHASE TWO OF THE ARRAY AUTOMATED ASSEMBLY TASK FOR THE LOW COST SOLAR ARRAY PROJECT Quarterly Report, 1 Oct. - 31 Dec. 1978
R. B. Campbell, D. J. Page, P. Rai-Choudhury, E. J. Seman, M. H. Hanes, A. Rohatsi, and J. R. Davis 31 Jan. 1979 44 p refs Sponsored in part by DOE
(Contracts NAS7-100; JPL-954873)
(NASA-CR-158359; QR-5) Avail: NTIS HC A03/MF A01 CSCL 10A

Various top contact metal systems were studied. Only Ti Pd Cu approaches baseline (Ti Pd Ag) quality, but this system shows a lack of long term stability. Aluminum back surface field structures were fabricated and thicknesses of p superscript + material of up to 7.0 microns were achieved with open circuit voltages of 0.59V. A general purpose ultrasonic welder was purchased and tests using various metal foils are under way. During fabrication of the demonstration module, several cells became cracked. Due to redundancy of interconnections, the module was not open circuited but the efficiency was reduced to 8.8%. The broken cell was interconnected with a strap across the back and the efficiency was increased to 11.5%. A cost analysis was made and the results indicate a selling price of $0.56/watt peak (in 1986 with 1975 dollars). L.S.

N79-20485*# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.
SILICON SOLAR CELL PROCESS DEVELOPMENT, FABRICATION AND ANALYSIS Quarterly Report, 1 Oct. - 31 Dec. 1978
H. I. Yoo, P. A. Iles, and D. P. Tanner 31 Dec. 1978 71 p refs Sponsored in part by DOE
(Contract JPL-955089)
(NASA-CR-158363; DOE/JPL-955089-79/1; QR-2) Avail: NTIS HC A04/MF A01 CSCL 10A

Ribbon to Ribbon (RTR) solar cells processed from polycrystalline feedstock showed maximum AMO efficiency of 5.6%. Solar cells from single crystalline feedstock showed slightly higher efficiency than those from polycrystalline feedstock, indicating maximum efficiency of about 6.6% with SiO AR coating. Single crystalline control cells gave 11-12% AMO efficiencies demonstrating that the poor performance of the RTR solar was due to the low quality of material itself. Dendritic web solar cells from the standard process showed maximum AMO efficiency of 9.8% while efficiency of control solar cells were around 11-12%. Web solar cells from back surface field (BSF) process indicated maximum AMO efficiency of 10.9%. Some improvement in open circuit voltage was noticed from the BSF process. Small light spot scanning experiments were carried out on the solar cells from Wacker Silso, EFG, RTR, and dendritic web ribbons. Photoresponse results provided information on localized cell performance and grain size in polycrystalline material, and agreed quite well with the cell performance data, such as efficiency, minority carrier diffusion length, and spectral response. L.S.

N79-20486*# Ross (Bernd) Associates, San Diego, Calif.
DEVELOPMENT OF ECONOMICAL IMPROVED THICK FILM SOLAR CELL CONTACT Quarterly Report
Bernd Ross and David Mentley Jan. 1979 45 p refs Sponsored by NASA Prepared for DOE and JPL
(Contract JPL-955164)
(NASA-CR-158358; DOE/JPL-955164-78/4; QR-1) Avail: NTIS HC A03/MF A01 CSCL 10A

Materials were surveyed to provide candidates for an all metal electrode paste system. These consisted of a major constituent metal powder, a low melting metal powder suitable for a liquid phase sintering medium, and a powder material suitable as an etchant for silicon dioxide at sintering temperatures. By means of thermal gravimetric analysis a suitable binder was identified for low temperature fired inks. The all metal ink concept

was first demonstrated with the silver system to avoid the problems of limited process windows encountered with base metal systems. A number of solid materials capable of selectively etching silicon dioxide at modest temperatures were identified. A paste with silver fluoride was screened onto N-type silicon with 5 ohm cm resistivity. The resulting contact pads had excellent adhesion but were not electrically ohmic. Metallurgically, these contacts have equal or better grain structure as commercial inks fired at the same temperatures. Author

N79-20487*# West Virginia Univ., Morgantown.
SIMULATION OF FLUIDIZED BED COAL COMBUSTORS Final Report
Renga Rajan Feb. 1979 215 p refs
(Grant NsG-3134)
(NASA-CR-159529) Avail: NTIS HC A10/MF A01 CSCL 10B

The many deficiencies of previous work on simulation of fluidized bed combustion (FBC) processes are presented. An attempt is made to reduce these deficiencies, and to formulate a comprehensive FBC model taking into account the following elements: (1) devolatilization of coal and the subsequent combustion of volatiles and residual char; (2) sulfur dioxide capture by limestone; (3) NOx release and reduction of NOx by char; (4) attrition and elutriation of char and limestone; (5) bubble hydrodynamics; (6) solids mixing; (7) heat transfer between gas and solid, and solid and heat exchange surfaces; and (8) freeboard reactions. G.Y.

N79-20488*# Federal Electric Corp., Houston, Tex.
AN ACCURACY ANALYSIS OF THE LDAR SYSTEM
Horst A. Poehler 8 Mar. 1977 93 p refs
(Contract NAS10-4967)
(NASA-CR-154631; FEC-7146) Avail: NTIS HC A05/MF A01 CSCL 10B

An accuracy report of the Lightning Detection and Ranging System is presented. The effect of quantizing errors are modelled by use of a computer. The errors in the four configurations of the LDAR System are compared to the limiting errors in an ideal hyperbolic system. Performance data from the track of a jet plane and for the indicated position of a fixed lightning simulator are analyzed for dispersions in the data. Error models show the quality and the areas of highly accurate data, and show how the data deteriorates outside the primary measuring range. Author

N79-20489# AIA Research Corp., Washington, D. C.
SOLAR DWELLING DESIGN CONCEPTS
Apr. 1978 147 p refs
(Contract IAA h-5574)
(HUD-PDR-156(3)) Avail: NTIS MF A01; SOD HC

A general resource document is presented which is intended for use by designers, home builders, community leaders, local officials and home owners who are interested in the application of solar heating and cooling to residential structures or are considering participating in the federal solar energy program. The publication provides historical background information, a concise report on existing solar dwellings and systems, a list of design considerations and numerous dwelling and site design concepts. G.Y.

N79-20490*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A FIXED TILT SOLAR COLLECTOR EMPLOYING REVERSIBLE VEE-THROUGH REFLECTORS AND EVALUATED TUBE RECEIVERS FOR SOLAR HEATING AND COOLING SYSTEMS
M. Kudret Selcuk Oct. 1978 95 p refs
(Contract NAS7-100)
(NASA-CR-158420; DOE/JPL-1024-78/1; JPL-Pub-78-106) Avail: NTIS HC A05/MF A01 CSCL 10A

The Vee-Trough/Evacuated Tube Collector (VTETC) was analyzed rigorously and various mathematical models were developed to calculate the optical performance of the vee-trough concentrators, and the quasi-steady state thermal performance of the evacuated tube receivers. Tests were run to verify the mathematical analyses. Back-silvered glass mirror, Alzak, Aluminized Teflon, and Kinglux (electropolished aluminum reflectors) were tested. Additional tests were run at temperatures ranging from 80 to 190 C (176-374 F). For the glass mirror reflectors, peak efficiencies, based on aperture area and operating temperatures of 125 C (257 F), were over 40%. Efficiencies of about 40% were observed at temperatures of 150 C (302 F) and 30% at 175 C (347 F). Test data for several days, predicted daily useful heats, and efficiency values are presented for a full year. These theoretical values were then compared with actual data points for the same temperature range. F.O.S.

N79-20491*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE PARABOLIC CONCENTRATING COLLECTOR: A TUTORIAL
V. C. Truscello 1 Mar. 1979 47 p Prepared for DOE
(Contract NAS7-100)
(NASA-CR-158246; DOE/JPL-1060-79/1; JPL-Pub-79-7; Rept-5102-107) Avail: NTIS HC A03/MF A01 CSCL 10A

A tutorial overview of point-focusing parabolic collectors is presented. Optical and thermal characteristics are discussed. Data representing typical achievable collector efficiencies are presented and the importance of balancing collector cost with concentrator quality is argued through the development of a figure of merit. Various types of two-axis tracking collectors are described. The Department of Energy program to develop these devices is briefly discussed, as are present and projected costs for these collectors. G.Y.

N79-20492*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL POWER SYSTEMS POINT-FOCUSING DISTRIBUTED RECEIVER TECHNOLOGY PROJECT. VOLUME 1: EXECUTIVE SUMMARY Annual Report
John Lucas 15 Feb. 1979 31 p
(Contract NAS7-100)
(NASA-CR-158421; DOE/JPL-1060-7; JPL-Pub-79-1-Vol-1; Rept-5104-26-Vol-1; JPL-5104-26) Avail: NTIS HC A03/MF A01 CSCL 10A

Thermal or electrical power from the sun's radiated energy through Point-Focusing Distributed Receiver Technology is the goal of this project. The energy thus produced must be technically, as well as economically, competitive with other energy sources. This project is to support the industrial development of the required technology to achieve the above stated goal. Solar energy is concentrated by either a reflecting surface or a lense to a receiver where it is transferred to a working liquid or gas. Receiver temperatures are in the 1000 - 2000 F range. Conceptual design studies are expected to identify power conversion units with a viable place in the solar energy future. Rankine and Brayton cycle engines are under investigation. This report details the Jet Propulsion Laboratory's accomplishments with point-focusing technology in Fy 1978. Author

N79-20493*# Colt, Inc. of Southern California, Rancho Mirage.
VERIFICATION TEST REPORT ON A SOLAR HEATING AND HOT WATER SYSTEM
21 Jul. 1978 60 p Prepared for DOE
(Contract NAS8-32242)
(NASA-CR-161165) Avail: NTIS HC A04/MF A01 CSCL 10A

Information is provided on the development, qualification and acceptance verification of commercial solar heating and hot water systems and components. The verification includes the performances, the efficiences and the various methods used, such as similarity, analysis, inspection, test, etc., that are applicable to satisfying the verification requirements. G.Y.

N79-20494*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
UTILITY OPERATIONAL EXPERIENCE ON THE NASA/DOE MOD-0A 200-kW WIND TURBINE
J. C. Glasgow and W. H. Robbins 1979 30 p refs Presented at the 6th Energy Technol. Conf., Washington, D. C., 26-28 Feb. 1979; sponsored by Am. Gas. Assoc. - Gas. Res. Inst., Elec. Power Res. Inst., and Thomas Alva Edison Found.
(Contract E(49-26)-1004)
(NASA-TM-79084; E9907; DOE/NASA/1004-79/1) Avail: NTIS HC A03/MF A01 CSCL 10B

The Mod-0A 200 wind turbine was designed and fabricated as part of the Federal Wind Energy Program. Early wind turbine

operation and performance data were obtained while gaining initial experience in the operation of large, horizontal axis wind turbines in typical utility environments. The Mod-0A wind turbine was turned over to the Town of Clayton Light and Water Plant, Clayton, NM, for utility operation and on December 31, 1978, the machine had completed ten months of utility operation. The machine is described and the recent operational experience at Clayton, NMis documented. J.M.S.

N79-20495*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

PERFORMANCE CHARACTERISTICS OF A 1.8 BY 3.7 METER FRESNEL LENS SOLAR CONCENTRATOR

Leon J. Hastings and Steve L. Allums 12 Feb. 1979 25 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Energy, Mar. - Apr. 1979

(NASA-TM-78222; EP43-79-5) Avail: NTIS HC A02/MF A01 CSCL 10A

Line-focusing acrylic Fresnel lenses with application potential in the 200 to 370 C range were analytically and experimentally investigated. The measured solar concentration characteristics of a 1.8 by 3.7 m lens and its utilization in a solar collection mode are presented. A measured peak concentration ratio of 62 with 90 percent of the transmitted energy focused into a 5.0cm width was achieved. A peak concentration of 59 and a 90 percent target width of 4.3 cm were analytically computed. The experimental and analytical lens transmittance was 78 percent and 86 percent, respectively. The lens was also interfaced with a nonevacuated receiver assembly and operated in the collection mode. With a natural oxide absorber tube coating (alpha/epsilon = 0.79/0.10), the measured collection efficiency ranged from 43 percent to 200 C to 34 percent at 260 C. Efficiency improvements to the 40 to 50 percent range can be achieved with second generation lenses and higher performance absorptive coatings. Author

N79-20496*# National Aeronautics and Space Administration. Pasadena Office, Calif.

MULTI-CHANNEL ROTATING OPTICAL INTERFACE FOR DATA TRANSMISSION Patent Application

Charles V. Olivie, inventor (to NASA) (JPL) Filed 25 Aug. 1977 12 p Sponsored by NASA

(NASA-Case-NPO-14066-1; US-Patent-Appl-SN-827464) Avail: NTIS HC A02/MF A01 CSCL 10C

An apparatus is presented for transmitting multiple channels of data across a rotating interface, such as between an antenna that rotates with respect to a platform. It includes a plurality of light-emitter elements and light detector elements located on the two bodies that rotate relative to each other. A lens for focusing light from each emitter element onto a corresponding detector element, and an image rotating means which is turned as one of the objects rotates is also included to derotate the images of the emitter elements that are to be focused on the detector elements. NASA

N79-20497*# Technical Report Services, Rocky River, Ohio.

EVALUATION OF URETHANE FOR FEASIBILITY OF USE IN WIND TURBINE BLADE DESIGN Final Report

Seymour Lieblein, Robert S. Ross (Concept Development Inst., Hudson, Ohio), and Demeter G. Fertis (Akron Univ.) Apr. 1979 156 p

(NASA Order C-7653; Contract E(49-26)-1028)

(NASA-CR-159530; DOE/NASA/7653-79/1; TRS-101) Avail: NTIS HC A08/MF A01 CSCL 10B

A preliminary evaluation was conducted of the use of cast urethane as a possible material for low-cost blades for wind turbines. Specimen test data are presented for ultimate tensile strength, elastic modulus, flexural strain, creep, and fatigue properties of a number of urethane formulations. Data are also included for a large-scale urethane blade section composed of cast symmetrical half-profiles tested as a cantilever beam. Based on these results, an analysis was conducted of a full-scale blade design of cast urethane that meets the design specifications of the rotor blades for the NASA/DOE experimental 100-kW MOD-0 wind turbine. Because of the low value of elastic modulus for urethane (around 457 000 psi), the design loads would have to be carried by metal reinforcement. Considerations for further evaluation are noted. Author

N79-20498*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMAL STORAGE TECHNOLOGIES FOR SOLAR INDUSTRIAL PROCESS HEAT APPLICATIONS

Larry H. Gordon 1979 19 p refs

(Contract EC-77-A-31-1034)

(NASA-TM-79130; DOE/NASA/1034-79/2; E-9970) Avail: NTIS HC A02/MF A01 CSCL 10A

The state-of-the-art of thermal storage subsystems for the intermediate and high temperature (100 C to 600 C) solar industrial process heat generation is presented. Primary emphasis is focused on buffering, and diurnal storage as well as total energy transport. In addition, advanced thermal storage concepts which appear promising for future solar industrial process heat applications are discussed. J.M.S.

N79-20499*# Alabama Univ. in Huntsville. Kenneth E. Johnson Environmental Energy Center.

COST ANALYSIS AND OPTIMIZATION STUDY FOR SOLAR HEATING AND COOLING SYSTEMS

William L. Reid and Robert E. Shannon Jan. 1979 51 p refs (Contract NAS8-31293)

(NASA-CR-161200) Avail: NTIS HC A04/MF A01 CSCL 10A

Detailed cost analyses of two operational test sites which are a part of a solar energy development program are presented. Actual costs and potential cost improvements of new and retrofit solar space conditioning and hot water systems for single family sized housing were studied. Operational test sites were used for evaluation as these projects are a part of the National Solar Heating and Cooling Demonstration Program. During the period involved in the initial cost analysis of the solar project, it became evident that a comparison of solar system costs with conventional heating, cooling, and hot water systems on a first cost basis was not sufficient for an overall view of life cycle costs for the consumer. J.M.S.

N79-20500# Argonne National Lab., Ill.

MDH BALANCE OF PLANT TECHNOLOGY PROJECT Quarterly Report, 1 Apr. 1978 - 30 Jun. 1978

Michael Petrick, Kenneth E. Tempelmeyer, and Terry R. Johnson Aug. 1978 62 p refs

(Contract W-31-109-eng-38)

(ANL-MHD-78-7; QR-2) Avail: NTIS HC A04/MF A01

The design and operation of the heat and seed recovery systems downstream of channel-diffuser and to the seed regeneration processes were studied. Engineering data needed to design components in MHD prototype and demonstration facilities were obtained. Activities discussed include: (1) preparation of a national program plan for heat and seed recovery systems; (2) analytical modeling of the heat transfer and seed-slag separation processes in the radiant boiler; (3) modeling of the formation growth, and behavior of slag and seed particles in the combustion gas stream; (4) studies of the thermochemistry of seed-slag systems; (5) investigations of ceramic and metallic materials for use in the downstream gas systems; (6) small-scale engineering studies of seed-slag deposition; (7) design and construction of a 2-MW experimental facility for investigations pertaining to the downstream gas system, and (8) evaluations of seed regeneration processes. J.M.S.

N79-20501# Department of Energy, Washington, D. C.

THE NATIONAL PROGRAM PLAN FOR BUILDING THERMAL ENVELOPE SYSTEMS AND INSULATING MATERIALS: TECHNOLOGY AND IMPLEMENTATION FOR ENERGY CONSERVATION

Paul R. Achenbach Jan. 1979 91 p refs

(DOE/CS-0059) Avail: NTIS HC A05/MF A01; SOD

This National Program Plan was prepared in response to an urgent need of the insulation and building community for more relevant technical information on the thermal performance of building envelope systems and in recognition of the impact that improved thermal performance of buildings would have on energy conservation, importation of fuel, and the economic health of the nation. The objective of the Plan is to provide the technical data, test procedures, guidelines and consensus standards needed by manufacturers, designers, and builders to produce buildings of high energy efficiency while concurrently meeting safety,

durability, habitability, and economic requirements. It also incorporates the activities needed to introduce these technical outputs into the commerce of building. Author

N79-20502# Brookhaven National Lab., Upton, N. Y.
METHODOLOGY FOR MODELING GEOTHERMAL DISTRICT HEATING FOR RESIDENTIAL MARKETS
John Karkheck and Raymond G. Tessmer, Jr. Aug. 1978 26 p refs
(Contract EY-76-C-02-0016)
(BNL-50905) Avail: NTIS HC A03/MF A01

Methodology is presented for modeling geothermal district heat service and for evaluating the economic market potential for such nonelectrical utilization of the geothermal resource. It is based upon accurate determination of the heating demand and its spatial and temporal profile in each potential market, determination of the cost to provide such service, and correlation of markets and resource sites. Two components of the model are discussed. The residential demand submodel and data base projects heating demand densities and temporal profiles along with building service modifications and costs. The service submodel and data base design and costs a substransmission and distribution network, and it evaluates operating losses at design conditions. Author

N79-20503# Argonne National Lab., Ill. Engineering Div.
PARAMETRIC STUDY OF THE PERFORMANCE OF A CDIF 1-B COAL-FIRED MHD GENERATOR
R. K. Ahluwalia, H. K. Geyer, and E. D. Doss Feb. 1979 51 p refs
(Contract W-31-109-eng-38)
(ANL-MHD-79-3) Avail: NTIS HC A02/MF A01

A comprehensive study is conducted into the analysis of a coal-fired Component Development and Integration Facility (CDIF) 1-B channel performance to simulate the characteristics of the reference Engineering Test Facility (ETF) channel. The performance criteria are established by careful review of the role played by the gas dynamic and electrical variables in determining channel behavior. On the basis of this review, a constant-velocity subsonic channel operating at nominal combustor pressure of 5.4 atm (0.54 MPa) is selected. The channel loading is selected to obtain a maximum Hall field of 2.4 kV/m and maximum transverse current density of 1.1 A/sq cm. Author

N79-20504# Battelle Pacific Northwest Labs., Richland, Wash.
DEVELOPMENT, CHARACTERIZATION AND EVALUATION OF MATERIALS FOR OPEN CYCLE MHD Quarterly Report, period ending Jun. 1978
J. Lambert Bates, D. D. Marchant, and J. L. Daniel Oct. 1978 65 p refs
(Contract EY-76-C-06-1830)
(PNL-2004-9) Avail: NTIS HC A04/MF A01

The program is directed toward the development and characterization of high temperature ceramics for open-cycle, coal-fired MHD power generators. The current activities are directed to electrode and insulator materials, and include: (1) determination of the effects of alkali seed on the behavior of ceramics in a dc electric field; (2) development and testing of improved high temperature ceramic electrodes and insulators with controlled composition, microstructure, and properties; and (3) characterization and evaluation of materials utilized in channels being tested for MHD power generator development. G.Y.

N79-20505# United Technologies Corp., South Windsor, Conn. Power Systems Div.
VENTURE ANALYSIS CASE STUDY FOR ON-SITE FUEL CELL ENERGY SYSTEMS Final Report
P. Bolan, P. Farris, and S. Folstad 31 Jul. 1978 76 p
(Contract EX-77-C-01-2684)
(FCR-0783-Vol-1) Avail: NTIS HC A05/MF A01

The benefits and the consequences of commercialization of on-site fuel cell energy systems were evaluated. In the business venture selected for this case study, gas utility companies would own and operate efficient, clean, quiet fuel cell power plants on the customer's premises and provide electrical and thermal energy services to the consumer upon demand. For each building, an integrated energy system is assumed where the fuel cell provides all of the electricity for lights and equipment; fuel cell heat is recovered for space and water heating; and fuel cell driven heat pumps, utilizing replenishable energy from the surroundings, provide space heating and cooling. Very high fuel utilization efficiencies, in the neighborhood of 100 percent, were measured in testing this type system. Success of this energy service venture depends upon gas company marketing and servicing efforts, and upon the manufacturer supplying reliable and economical fuel cell power plants. J.M.S.

N79-20506# Battelle Pacific Northwest Labs., Richland, Wash.
WIND DIRECTION CHANGE CRITERIA FOR WIND TURBINE DESIGN
W. C. Cliff Jan. 1979 17 p refs
(Contract EY-76-C-06-1830)
(PNL-2531) Avail: NTIS HC A02/MF A01

A method is presented for estimating the root mean square (rms) value of the wind direction change, Delta Theta (tau) = theta (tau + tau) - Theta (tau), that occurs over the swept area of wind turbine rotor systems. An equation is also given for the rms value of the wind direction change that occurs at a single point in space, i.e., a direction change that a wind vane would measure. Equations are given for calculating the expected number of wind direction changes, larger than an arbitrary value, that will occur in 1 hr as well as the expected number that will occur during the design life of a wind turbine. The equations are developed using a small angle approximation and are, therefore, considered appropriate for wind direction changes of less than 30 degrees. The equations are based upon neutral atmospheric boundary-layer conditions. G.Y.

N79-20507# Argonne National Lab., Ill.
TECHNICAL SUPPORT FOR OPEN-CYCLE MHD PROGRAM Progress Report, 1 Jan. - 31 Mar. 1978
J. Patten, ed. May 1978 104 p refs
(Contract W-31-109-eng-38)
(ANL-MHD-78-8) Avail: NTIS HC A06/MF A01

The support program for open-cycle MHD (magnetohydrodynamic) at Argonne National Lab is developing the analytical tools needed to investigate the performance of the major components in the combined-cycle MHD/steam power system. The analytical effort is centered on the primary components of the system that are unique to MHD and also on the integration of these analytical representations into a model of the entire power producing system. The present project activities include modeling of the combustor, MHD channel, slag separator, and the high-temperature air preheater. These models are combined into a complete system model, which is at present capable of carrying out optimizations of the entire system on either thermodynamic efficiency or with less confidence, cost of electrical power. Author

N79-20508# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
MEASUREMENT AND CONTROL TECHNIQUES IN GEOTHERMAL POWER PLANTS
J. F. Whitbeck, R. H. Dart, J. D. Miller, and D. R. Brewer (Rogers Engineering) Jan. 1979 80 p refs
(Contract EY-76-C-07-1570)
(TREE-1312) Avail: NTIS HC A05/MF A01

The background and source material used in preparing the chapter of the Geothermal Source Book on instrumentation, measurement, and control techniques is provided. Included are detailed examples of instrumentation and control techniques currently being used in geothermal power plants. In addition, the basic guidelines and unique characteristics of instrumentation and control in geothermal systems, are presented. G.Y.

N79-20509# Department of Energy, Washington, D. C. Office of Energy Use Analysis.
MEASURING ENERGY CONSERVATION
Dec. 1978 44 p refs
(DOE/EIA-0103/18; TM/EU/79-06) Avail: NTIS HC A03/MF A01

The meaning of energy conservation is briefly examined and alternative methods for measuring energy conservation are described. Current methods employed to forecast the impacts of energy conservation programs are included along with energy models, capable of analyzing the impacts of energy conservation legislation or the use of more energy-efficient equipment. J.M.S.

N79-20510# TRW Defense and Space Systems Group, Redondo Beach, Calif.
HIGH PRESSURE MHD COAL COMBUSTORS INVESTIGATION Quarterly Technical Progress Report, 15 May - 15 Aug. 1978
John A. Hardgrove 15 Aug. 1978 52 p
(Contract ET-78-C-01-2706)
(FE-2706-08; QTPR-2) Avail: NTIS HC A04/MF A01

Progress during this reporting period included the following: Assembled and checked out the combustor and instrumentation; completed design of the average conductivity section; conducted over-drying tests of coal in 50-lb paper bags; conducted 32 combustor test firings; investigated the effects of first stage stoichiometry and coal injector configuration and position; tested a technique for mechanically retaining slag on the combustor walls; set up and tested the seed injection system; and used the breadboard sodium D-line temperature measuring equipment for plasma thermal characterization during three coal firing tests. G.Y.

N79-20511# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
CRITICAL CONTRIBUTIONS IN MHD POWER GENERATION Quarterly Technical Progress Report, 1 Dec. 1977 - 28 Feb. 1978
J. F. Louis Mar. 1978 179 p refs
(Contract EF-76-C-01-2215)
(FE-2215-11) Avail: NTIS HC A09/MF A01

During the last year work was focused primarily on electrode and insulator systems for the generator. The major results reported were the engineering data for the spinel module. The current thrust is on superhot wall materials based on zirconates. New and important results from the laboratory measurements were translated into working electrode modules. Detailed description of technical progress is given for the following tasks: (1) electrode module materials evaluation; (2) electrode module development; (3) coal combustion studies; (4) critical phenomena in MHD generators; (5) studies in a disk generator; (6) MHD component modeling; (7) MHD generator modeling; (8) paticipation in US USSR cooperative MHD program; and (9) Dept. of Energy/MHD Program support. G.Y.

N79-20512# Stanford Univ., Calif.
AXIAL FIELD LIMITATIONS IN MHD GENERATORS
William C. Unkel Apr. 1978 392 p refs
(Contract EX-76-C-01-2341)
(FE-2341-8) Avail: NTIS HC A17/MF A01

The results of an investigation of axial field breakdown in nonslagging wall, combustion driven MHD generators are presented. Breakdown was characterized by a rapid decline in axial voltage and a change in the mode of current transport from a relatively diffuse mode to a highly constricted and extremely destructive mode. Cinephotographic records demonstrated that breakdown could be initiated in the plasma or in the interelectrode insulator. Plasma initiated and insulator initiated breakdown resulted only when a threshold voltage was exceeded. For the electrode wall configuration studied, the threshold voltage for plasma initiated breakdown was significantly higher than the threshold voltage for insulator initiated breakdown. Electro-thermal instability was responsible for the behavior observed in the experiments. A computer model was developed to predict the nonbreakdown and incipient breakdown behavior for the interelectrode insulator region for the simplified configuration.
Author

N79-20513*# National Aeronautics and Space Administration. Pasadena Office, Calif.
AN IMPROVED SOLAR ENERGY RECEIVER FOR A STIRLING ENGINE Patent Application
M. Kudret Selcuk, inventor (to NASA) (JPL) Filed 6 Apr. 1979 12 p
(Contract NAS7-100)
(NASA-Case-NPO-14619-1; US-Patent-Appl-SN-027559) Avail: NTIS HC A02/MF A01 CSCL 10A

Damage to a Stirling engine is prevented by using a solar receiver of separable configuration to reduce solar flux density in order to protect the heat exchanger contained within the receiver. A solar energy receiver includes a separable endless wall formed of a ceramic material in which a cavity of a substantially cylindrical configuration is defined for entrapping solar flux. An acceptance aperture admits a concentrated beam of solar energy to the cavity. The wall is characterized by at least one pair of contiguously related segments separated by lines of cleavage intercepting the aperture. At least one of the segments is supported for pivotal displacement. A thermalresponsive actuator is adapted to respond to excessive temperatures within the cavity for initiating pivotal displacement of one segment, so that thermal flux is permitted to escape from the cavity.
NASA

N79-20514# Department of Energy, Washington, D. C.
ENVIRONMENTAL IMPACT DETERMINATION OF ACTION TO BE TAKEN UNDER THE ENERGY SUPPLY AND ENVIRONMENTAL COORDINATION ACT FOR POWERPLANTS 1, 2, 3, AND 4, PORTSMOUTH GENERATING STATION, PORTSMOUTH, VIRGINIA
Mar. 1978 119 p refs
(DOE/EA-0033) Avail: NTIS HC A06/MF A01

An environmental assessment of the proposed Notice of Effectiveness is given to make effective the prohibition order prohibiting burning of gas or oil as the primary energy source at the Portsmouth Generating Station power plants (Virginia Electric Power Company). A description of the facility and its surroundings, along with alternative generating station operations are discussed. Conversion effects on: air quality; land use/solid wastes; water quality and uses; ecosystems; and esthetics, are also discussed. G.Y.

N79-20515# General Electric Co., Philadelphia, Pa. Space Div.
MHD-ETF PROGRAM. VOLUME 1: EXECUTIVE SUMMARY Final Report, 4 Jan. 1977 - 4 Mar. 1978
Mar. 1978 56 p
(Contract EF-77-C-01-2613)
(FE-2613-6-Vol-1) Avail: NTIS HC A04/MF A01

A conceptual design study was performed to establish a reference design for a magnetohydrodynamic engineering test facility (MHD-ETF). Alternative conceptual designs were developed to the point where an evaluation and selection of a preferred concept could be made. The preferred conceptual design was then updated to provide an ETF reference design. Capital cost estimates and operating and maintenance cost estimates were then prepared. Critical advanced technology development requirements were identified. The ETF system configuration is a 250 MWt size, coal fired, MHD/Steam combined cycle plant.
Author

N79-20516# General Electric Co., Philadelphia, Pa. Space Div.
MHD-ETF PROGRAM. VOLUME 2A, PARTS 1 AND 2: REFERENCE DESIGN DESCRIPTION Final Report, 4 Jan. 1977
Mar. 1978 238 p refs
(Contract EF-77-C-01-2613)
(FE-2613-6-Vol-2A) Avail: NTIS HC A11/MF A01

Volume 2A, Parts 1 and 2, of a multivolume report is given. Part 1 gives a system design description and rationale and discusses the following: groundrules, size and flexibility; degree of slag rejection; NOx prediction and its influence on the system; supercritical vs. subcritical boiler; system configuration (and with bottom only); performance analysis; system operation; and reliability and maintainability. Part 2 gives the plant design description and includes discussion on the following: site; plant buildings, structures and improvements; boiler plant; steam turbine (generator and auxiliaries); accessory electrical equipment (production plant); miscellaneous power plant equipment; magnetohydrodynamic cycle equipment; research equipment and centralized instrumentation and control equipment; and transmission plant. G.Y.

N79-20517# Montana Energy and MHB Research and Development Inst., Inc., Butte.
MHD POWER GENERATION: RESEARCH, DEVELOPMENT AND ENGINEERING Quarterly Progress Report, Jan. - Mar. 1978
Mar. 1978 259 p refs

(Contract EF-77-C-01-2524)
(FE-2524-8) Avail: NTIS HC A13/MF A01

A special compilation of several task reports under contract to the U. S. Department of Energy is presented. Summarizing the work accomplished from January to March 1978, the reports cover the MERDI (Montana Energy and MHD Research and Development Institute) Materials Evaluation task and the tasks being performed by the Montana College of Mineral Science and Technology and Montana State University. G.Y.

N79-20518# Montana Energy and MHB Research and Development Inst., Inc., Butte.

MHD POWER GENERATION: RESEARCH, DEVELOPMENT AND ENGINEERING Quarterly Progress Report, Apr. - Jun. 1978

Jun. 1978 209 p refs
(Contract ET-78-C-01-3087)
(FE-3087-2) Avail: NTIS HC A10/MF A01

The Montana Energy and MHD Research and Development Institute (MERDI) was established in Butte, Montana in 1974 to develop methods for conserving western energy sources and to carry out supporting science and technology tasks for the national magnetohydrodynamic (MHD) program. Under contract to the U.S. Department of Energy, these tasks were divided among researchers at MERDI, the Montana Colleges of Mineral Science and Technology (MCMST), and Montana State University (MSU). The work accomplished by MERDI, MCMST, and MSU from April through June 1978 are summarized. G.Y.

N79-20519*# North Carolina Science and Technology Research Center, Research Triangle Park.

AN ANALYTICAL INVESTIGATION OF THE PERFORMANCE OF SOLAR COLLECTORS AS NIGHTTIME HEAT RADIATORS IN AIRCONDITIONING CYCLES Final Report

Clay B. Jones and Frederick O. Smetana Mar. 1979 62 p refs
(Contract NAS1-14208)
(NASA-CR-3111) Avail: NTIS HC A04/MF A01 CSCL 10A

It was found that if the upper and lower ends of a collector were opened, large free convention currents may be set up between the collector surface and the cover glass(es) which can result in appreciable heat rejection. If the collector is so designed that both plates surfaces are exposed to convection currents when the upper and lower ends of the collector enclosure are opened, the heat rejection rate is 300 watts sq m when the plate is 13 C above ambient. This is sufficient to permit a collector array designed to provide 100 percent of the heating needs of a home to reject the accumulated daily air conditioning load during the course of a summer night. This also permits the overall energy requirements for cooling to be reduced by at least 15 percent and shift the load on the utility entirely to the nighttime hours. Author

N79-20520*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DECAY OF THE ZINCATE CONCENTRATION GRADIENT AT AN ALKALINE ZINC CATHODE AFTER CHARGING

Harold E. Kautz and Charles E. May 1979 21 p refs To be presented at the Meeting of the Electrochem. Soc., Los Angeles, 14-19 Oct. 1979
(NASA-TM-79106; E-9931) Avail: NTIS HC A02/MF A01 CSCL 10C

The transport of the zincate ion to the alkaline zinc cathode was studied by observing the decay of the zincate concentration gradient at a horizontal zinc cathode after charging. This decay was found to approximate first order kinetics as expected from a proposed boundary layer model. The concentrations were calculated from polarization voltages. The decay half life was shown to be a linear function of the thickness of porous zinc deposit on the cathode indicating a very rapid transport of zincate through porous zinc metal. The rapid transport is attributed to an electrochemical mechanism. From the linear dependence of the half life on the thickness the boundary layer thickness was found to be about 0.010 cm when the cathode was at the bottom of the cell. No significant dependence of the boundary layer thickness on the viscosity of electrolyte was observed. The data also indicated a relatively sharp transition between the diffusion and convection transport regions. When the cathode was at the top of the cell, the boundary layer thickness was found to be roughly 0.080 cm. The diffusion of zincate ion through asbestos submerged in alkaline electrolyte was shown to be comparable with that predicted from the bulk diffusion coefficient of the zincate ion in alkali. J.M.S.

N79-20521# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.

SAFETY STUDIES OF LITHIUM-SULFUR DIOXIDE CELLS Final Report, 1 Sep. 1977 - 30 Apr. 1978

A. N. Dey Nov. 1978 51 p refs
(Contract DAAB07-77-C-0458)
(AD-A062708; DELET-TR-77-0458-F) Avail: NTIS HC A04/MF A01 CSCL 10/3

The objective of this program was to improve the abuse resistance of Li/SO2 cells. LO26S cells were chosen for the study. The effect of cell design variables such as Li:SO2 ratio, electrode configuration and electrolyte compositions on the abuse resistance as well as the performance of the LO26S cells were studied in order to establish the trade-offs between the cell performance and the increased abuse resistance. Several cell designs which improved the abuse resistance of the LO26S cells for abuses consisting of a 2A forced discharge at -30C were found. This design entails a capacity penalty of approximately 3 A.Hr at low rates over the standard LO26S cells. However, at high rates (2A or more) there was no capacity penalty. Several design principles contributing to the safety of the Li/SO2 cells have been identified. The cell design variables did not appear to have any significant effect on the abuse resistance of cells for abuses such as charging. In general LO26S cells of all designs were abuse resistant towards charging at currents below 2A. Author (GRA)

N79-20522# Army Construction Engineering Research Lab., Champaign, Ill.

DESIGN OF SOLAR HEATING AND COOLING SYSTEMS Final Report

David M. Joncich, Donald James Leverenz, Douglas C. Hittle, and George N. Walton Oct. 1978 59 p refs
(DA Proj. 4A7-62731-AT-41)
(AD-A062719; CERL-TR-E-139) Avail: NTIS HC A04/MF A01 CSCL 13/1

This report presents a method for making an energy and an economic cost/benefit analysis of solar energy systems. A graphical method is presented for evaluating the performance of solar domestic hot water system, solar heating systems, and solar heating and cooling systems. Methods for selecting the optimum collector area based on benefit-to-cost ratio and for systematically making detailed design calculations using the Building Loads Analysis and System Thermodynamics (BLAST) computer simulation program are also presented. Practical considerations for solar system designs are discussed. The methods presented provide the required accuracy for both initial evaluations and final design calculations. Examples are provided throughout the text to aid in using the methods described. Author (GRA)

N79-20523# Naval Surface Weapons Center, White Oak, Md.

DIFFUSION STUDIES ON A PPQ-CA MEMBRANE: A COMPARISON WITH STANDARD MEMBRANE MATERIALS

William P. Kilroy and Linda Laughlin 4 Dec. 1978 24 p refs
(AD-A062150; NSWC/WOL/TR-78-174) Avail: NTIS HC A02/MF A01 CSCL 10/3

This report discusses zincate and electrolyte diffusion through a new separator material currently being developed for potential use in alkaline AgO-Zn batteries. Author (GRA)

N79-20524# National Bureau of Standards, Washington, D. C. Building Economics and Regulatory Technology Div.

LABORATORIES TECHNICALLY QUALIFIED TO TEST SOLAR COLLECTORS IN ACCORDANCE WITH ASHRAE STANDARD 93-77: A SUMMARY REPORT Final Report

William J. Niessing Nov. 1978 40 p
(Contract EA-77-A-01-6010)
(PB-289729/6; NBSIR-78-1535) Avail: NTIS HC A03/MF A01 CSCL 14B

The procedures used by ARI Foundation Inc. and the results of their evaluation are described. The laboratories evaluated as

qualified to test solar collectors in accordance with American Society of Heating, Refrigerating and Air-Conditioning Engineers Standard 93-77 are listed. GRA

N79-20525# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
SOLAR ENERGY PILOT STUDY Final Report
Oct. 1978 100 p Prepared by Maryland Univ., College Park (Contract EY-76-S-05-4908)
(PB-289380/8; NATO/CCMS-83; UMD-4908-13) Avail: NTIS HC A05/MF A01 CSCL 13A

The CCMS Solar Energy Pilot Study was established in 1973 with the objective of encouraging the cost-effective and practical application if solar energy to heating and cooling in residential, commercial, industrial, agricultural, and public buildings. The scope of the pilot study has been the exchange of information on: (1) national solar heating and cooling programs; (2) solar heating and cooling experiments, with emphasis on system performance data; and (3) specialized regional applications of solar heating and cooling. The various elements of this multilateral cooperative program are discussed. GRA

N79-20526# Illinois Valley Economic Development Corp., Carlinville.
SOLAR SPACE HEATERS FOR LOW-INCOME FAMILIES
Roger Fenton and Patti Donahue Sep. 1978 29 p refs Sponsored by Illinois Inst. of Natural Resources.
(PB-289244/6; ILLDOE-78/09) Avail: NTIS HC A03/MF A01 CSCL 13A

The publication is a manual designed to guide individuals in the construction and installation of a low-cost window-box solar collector. Included are explanations of solar collector fundamentals, lists of construction and installation materials and tools, step-by-step procedures for building and installing a unit and an extensive bibliography of information on home weatherization and solar energy use. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N79-20527*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INDUSTRIAL POTENTIAL, USES, AND PERFORMANCE OF SPUTTERED AND ION PLATED FILMS
Talivaldis Spalvins 1979 16 p refs Presented at the 22nd Ann. Tech. Conf. of the Soc. of Vacuum Coaters, New Orleans, 28-30 Mar. 1979
(NASA-TM-79107; E-9932) Avail: NTIS HC A02/MF A01 CSCL 20A

The sputtering and ion plating technology is reviewed in terms of their potential, uses and performance. It offers the greatest flexibility in coating preparation, since coatings can be tailored in any preferred chemical combination, and graded type interfaces (ceramic to metal seals) can be formed. Sputtered and ion plated film characteristics such as the degree of adherence, coherence and morphological growth which contribute to film performance and reliability are described and illustrated as used in practice. It is concluded that the potential future of sputtered and ion plated films for industrial applications will depend primarily upon greater comprehension of materials selection, possible elimination of restrictions for coating/substrate combinations and the awareness of utilizing the proper deposition parameters. Author

N79-20528*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF AIR INJECTION ON A TURBOCHARGED TELEDYNE CONTINENTIAL MOTORS TSIO-360-C ENGINE
Donald V. Cosgrove and Erwin E. Kempke 1979 37 p refs Presented at the Business Aircraft Meeting, Wichita, Kans., 3-6 Apr. 1979; sponsored by the Soc. of Automotive Engr.
(NASA-TM-79121; E-9955) Avail: NTIS HC A03/MF A01

A turbocharged fuel injected aircraft engine was operated over a range of test conditions that included that EPA five-mode emissions cycle and fuel air ratio variations for individual modes while injecting air into the exhaust gas. Air injection resulted in a decrease of hydrocarbons and carbon monoxide while exceeding the maximum recommended turbine inlet temperature of 1650 F at the full rich mixture of the engine. Leanout tests indicated that the EPA standards could be met through the combined use of fuel management and air injection. Author

N79-20529# Naval Research Lab., Washington, D. C.
DETECTION AND MONITORING OF AIRBORNE NUCLEAR WASTE MATERIALS Annual Report
J. R. McDonald, A. P. Baronavski, L. R. Pasternack, V. M. Donnelly, and R. C. Clark 11 Dec. 1978 98 p refs
(Contract EY-76-C-05-5057)
(AD-A062342; NRL-MR-3895) Avail: NTIS HC A05/MF A01 CSCL 18/4

The Chemistry Division of the Naval Research Laboratory in cooperation with the Department of Energy is carrying out research relating to detection, monitoring, and removal of several airborne species associated with nuclear facilities. Two of these projects relate to aerosol species. A series of new materials and formulations for manufacture of HEPA aerosol filters have been evaluated. A new fluorescence aerosol detection technique has been developed for challenging HEPA filter materials and installations. A new laser fluorescence Iodine-129 measurement technique has been developed for air monitoring. This detector has been perfected and a commercial prototype has been manufactured for field tests. An optical detection scheme for measurement of airborne tritium has been developed. Most of the components for this detector has been specified. A feasibility study was carried out to determine the potential for development of an optical diagnostic for measurement of airborne carbon-14. An optical detection scheme with an ultimate sensitivity of less than one part per trillion was specified. This instrumentation should be more economical than currently used techniques which have a detection limit of 100 parts per billion. Author (GRA)

N79-20530# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla.
PARTICLE COLLECTION BY WATER INJECTION IN TEST CELLS Interim Report, 1 Sep. - 1 Oct. 1978
Peter S. Daley and Dale A. Lundgren Nov. 1978 9 p refs
(AD-A062154; CEEDO-TR-78-51) Avail: NTIS HC A02/MF A01 CSCL 21/2

This report summarizes the mechanisms by which particles may be removed when water is injected into turbine engine test cell exhaust streams. The report concludes that impaction between soot particles and droplets is the most important mechanism and that there is an optimum flow rate at which water should be injected to assure maximum removal efficiency. GRA

N79-20531# Air Force Geophysics Lab., Hanscom AFB, Mass.
SWIR-MWIR ELECTRON FLUORESCENCE MEASUREMENTS IN N2/O2 AND AIR
B. D. Green, G. E. Caledonia, and R. E. Murphy 4 Apr. 1978 31 p refs
(AD-A062452; AFGL-TR-78-0083; AFGL-ERP-629; DNA-HAES-76) Avail: NTIS HC A03/MF A01 CSCL 17/5

The infrared fluorescence of electron irradiated room air and mixtures of N2/O2 has been observed over the spectral range of 1600-6700/cm. Dominant spectral features include the NO fundamental and first overtone bands as well as the CO2(nu3) and N2O(nu3) fundamental bands. Comparisons between the spectra observed in room air and laboratory N2/O2 mixtures are provided. Author (GRA)

N79-20532# Argonne National Lab., Ill. Energy and Environmental Systems Div.
PRIORITIES FOR NEW SOURCE PERFORMANCE STANDARDS UNDER THE CLEAN AIR ACT AMENDMENTS OF 1977 Final Report
M. R. Monarch, R. R. Crillo, B. H. Cho, G. A. Concaildi, and A. E. Smith Apr. 1978 253 p
(PB-289214/9; EPA-450/3-78-019) Avail: NTIS HC A12/MF A01 CSCL 13B

A methodology that has been developed for prioritizing source categories using the Clean Air Act criteria is described. The

methodology, which employs three distinct computer programs, was applied to a data set of over 150 major source categories for nine different air pollutant emissions (particular matter, sulfur dioxide, nitrogen oxides, hydrocarbons, carbon monoxide, lead, sulfuric acid mist, hydrogen sulfide, and fluorides). The methodology provides for giving different weight to each of the Clean Air Act criteria and the establishment of distinct future year goals of achievement for each pollutant. The program output is a prioritized list of source categories for NSPS promulgation over a ten year period based on a multipollutant source category emission analysis. GRA

N79-20533# Cincinnati Univ., Ohio. Dept. of Environmental Health.

INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: ASPHALT AND COAL TAR PITCH Final Report

Ruth P. Trosset, David Warshawsky, Lee Menefee, and Eula Bingham Sep. 1978 241 p refs

(Contract EPA-68-01-4188)

(PB-289128/1; EPA-560/2-77-005) Avail: NTIS HC A11/MF A01 CSCL 13B

The potential environmental hazards and health impacts from production, distribution, and use of asphalt, the essentially uncracked residue from crude oil, and coal tar pitch were reviewed. Topics include physical and chemical properties; production figures; uses; process descriptions; contamination potential; methods of sampling, monitoring, and analysis; acute and chronic effects on human health; toxicity to animals and plants; suggested handling practices; regulations and standards. GRA

N79-20534# Eastern Connecticut State College, Willimantic.

ANALYSIS OF CURRENT LAND-USE AND ZONING VERSUS SELECTED ENVIRONMENTAL FACTORS IN DRAINAGE BASINS CONTAINING LAKES OR PONDS

Henry I. Snider, Michael Gable, and R. Max Ferguson Mar. 1978 16 p refs

(Contract DI-14-31-0001-3507)

(PB-289241/2; W79-01589; OWRT-A-068-CONN(1)) Avail: NTIS HC A02/MF A01 CSCL 13B

Land Use, soils, and lake water chemistry were studied in 12 lake drainage basins in eastern Connecticut. Housing and agriculture are the most prevalent uses of land in the lake watersheds; however, the percentage of use varies substantially. Soil studies were based on Natural Soils Groups which also varied from basin to basin. In general, the most adaptable land for urban development was the first used for residential subdivision. Further residential intensification, especially on hardpan soils, could become a major factor in eutrophication acceleration and water pollution. The relationship of land use and soils water chemistry is complex and must consider regional differences in waters prior to examination for change. GRA

N79-20535# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).

GLOSSARY OF TERMS: A REPORT OF THE NATO/CCMS PILOT STUDY ON AIR POLLUTION ASSESSMENT METHODOLOGY AND MODELING

Oct. 1978 90 p

(PB-289376/6; NATO/CCMS-89) Avail: NTIS HC A05/MF A01 CSCL 13B

This document establishes a comprehensive glossary of terms used in air pollution assessment methodology and modeling. GRA

N79-20536# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).

INTRODUCTION TO AIR QUALITY MODELING: A REPORT OF THE NATO/CCMS PILOT STUDY ON AIR POLLUTION ASSESSMENT METHODOLOGY AND MODELING

Oct. 1978 31 p

(PB-289377/4; NATO/CCMS-99) Avail: NTIS HC A03/MF A01 CSCL 13B

The methods used for modeling, in particular for models to be used in AQMS were reviewed. Indications where they could preferably be applied and their advantages and disadvantages are presented. The problems connected with the application of models are summarized. GRA

N79-20537# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).

BIBLIOGRAPHY ON GREY LITERATURE ON AIR QUALITY MODELING. PART 2: NEW TECHNIQUES

Oct. 1978 123 p

(PB-289501/9; NATO/CCMS-88) Avail: NTIS HC A06/MF A01 CSCL 13B

The state of the art of air quality modeling and to show international trends in model standardization was reviewed. Technical Document was prepared into two parts: (1) Bibliography of Grey Literature on Air Quality Modeling (especially Gaussian Plume Models) and (2) Bibliography of Grey Literature on Air Quality Modeling (New Models). GRA

N79-20538# Pacific Environmental Services, Inc., Santa Monica, Calif.

COMPARISON OF AMBIENT NMHC/NOx RATIOS WITH NMHC/NOx RATIOS CALCULATED FROM EMISSION Final Report

Peter J. Drivas Jun. 1978 60 p refs

(Contract EPA-68-02-2583)

(PB-288989/7; EPA-450/3-78-026) Avail: NTIS HC A04/MF A01 CSCL 13B

The Empirical Kinetic Modeling Approach (EKMA) requires the determination of the ratio of nonmethane hydrocarbons (NMHC) to oxides of nitrogen (NOx). Three geographic locations were used in analyzing the differences between NMHC/NOx ratios calculated from emission inventory data and those from ambient monitoring data. The three locations were Los Angeles, California; San Francisco, California; and St. Louis, Missouri. The relationship between ambient monitoring NMHC/NOx ratios and emission inventory NMHC/NOx ratios was tested by applying a linear regression analysis to air quality and emission data from a number of monitoring stations in each region. The relationship was tested for each of five high-oxidant days in each of the three locations. GRA

N79-20539# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.

COMPILATION OF AIR POLLUTANT EMISSION FACTORS, 3RD EDITION (INCLUDING SUPPLEMENTS 1-7), SUPPLEMENT NO. 8

May 1978 107 p refs

(PB-288905/3; AP-42-ED-3-Suppl-8) Avail: NTIS HC A06/MF A01 CSCL 13B

Emissions data are presented for wood stoves, refuse incineration, open burning, off-highway stationary sources, primary copper smelting, secondary copper smelting and alloying, cotton ginning, ammonium nitrate fertilizer manufacturing asphaltic concrete plants, asphalt roofing manufacturing, glass manufacturing petroleum refining, unpaved roads, and paved roads. GRA

N79-20540# Iowa State Dept. of Environmental Quality, Des Moines.

IOWA DEPARTMENT OF ENVIRONMENTAL QUALITY 1976-1977 Annual Report

1978 29 p

(PB-290383/9) Avail: NTIS HC A03/MF A01 CSCL 13B

The Iowa Department of Environmental Quality's Annual Report for fiscal year 1976-77 is organized into three major program areas: air quality, land quality, and water quality. Activities of each area are reviewed along with goals for the future. The department's organizational structure and financial summary complete the report. GRA

N79-20541# Environmental Protection Agency, Washington, D. C.

A FORTRAN PROGRAM FOR COMPUTING THE POLLUTANT STANDARDS INDEX (PSI)

Wayne R. Ott May 1978 73 p refs

(PB-289924/3; EPA-600/4-78-001) Avail: NTIS HC A04/MF A01 CSCL 13B

A FORTRAN computer program is designed to calculate the Pollutant Standards Index (PSI). The PSI proposed in the Federal Register by the Environmental Protection Agency as a nationally uniform air pollution index, and is intended for use by state and local air pollution control agencies. This computer program can

compute daily index values for a month, a season, a year, or longer. The program consists of 563 FORTRAN statements and contains seven specialized subroutines. By use of the subroutines, the main program: lists the raw data, along with any data set labels; inventories missing values in the data set; plots a time series graph of PSI values on the line printer; calculates statistics for PSI and generates and plots a frequency distribution of PSI values. GRA

N79-20542# California State Dept. of Health, Berkeley. Air and Industrial Hygiene Lab.

INVESTIGATION OF PARTICULATE MATTER MONITORING USING CONTACT ELECTRICITY Final Report

Walter John, George Reischl, William Devor, and Jerome J. Wesolowski Oct. 1978 81 p refs

(Grant EPA-R-803719-61-2)

(PB-289565/4; EPA-600/2-78-212) Avail: NTIS HC A05/MF A01 CSCL 14B

Monodisperse, uniformly charged or neutral aerosol particles from a vibrating orifice or fluidized bed generator were bounced on a metal probe. The transfer of precharge from the particles were found to be sensitive indicators of the probe surface condition. A surface preparation procedure was developed which yielded linear charge transfer curves. Measurements were made of methylene blue, potassium biphthalate, sodium chloride and aluminum particles impacting on stainless steel, inconel, titanium and platinum probes. For insulating materials, the transfer of precharge was independent of particle size while the contact charge was proportional to the cube of particle diameter and directly proportional to impact velocity. The magnitude of the contact charge was strongly dependent on the electrical resistivity of the material. A theoretical model was found to account semi-quantitatively for all aspects of the data. A major remaining difficulty is the lack of knowledge of the contact potential. The implications of these findings for monitoring applications is discussed in detail and the advantages and disadvantages of the monitor are assessed. GRA

N79-20543# Auburn Univ., Ala. Dept. of Civil Engineering.

THE EFFECTIVENESS OF SAND FILTERS FOR THE REMOVAL OF SPECIFIC VIRUSES FROM WATER USING SELECTED CATIONS AS FILTER AIDS

Stephen R. Jenkins Sep. 1978 80 p refs Sponsored by the Office of Water Research and Technology, Washington, D. C.

(PB-289044/0; WRRI-BULL-33; W79-01352; OWRT-B-065-ALA(1)) Avail: NTIS HC A05/MF A01 CSCL 13K

Calcium was shown to enhance the removal of T1 coliphage by model rapid sand filters. The concentration of calcium necessary to cause effective removal of the virus was stoichiometric with the virus titer. The effectiveness of the one-inch ID 4-inch deep model filters to remove T1 coliphage in the presence of calcium decreased as the sand grain size increased and as the filtration rate increased. Ca(+2) enhanced removal most effectively at slightly acid pH's. That is, more Ca(+2) is required to produce effective removal of the virus as the pH is raised. Alkametric titration curves were unreliable for determining the extent of complexation between the Ca(+2) and the T1 coliphage. The titration curves indicated that the beef extract broth and the host cell Escherichia Coli also complexed with the Ca(+2). Isolation of the virus particles would be necessary for more conclusive results. GRA

N79-20544# National Oceanic and Atmospheric Administration, Boulder, Colo. Outer Continental Shelf Environmental Assessment Program.

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. INTERIM SYNTHESIS: BEAUFORT/CHUKCHI

Aug. 1978 370 p refs Sponsored in part by the Bureau of Land Management

(PB-289720/5; NOAA-78111302) Avail: NTIS HC A16/MF A01 CSCL 13B

Twelve baseline studies are compiled providing information on: the sea ice environment; physical oceanography and meteorology; earth sciences; marine mammals; birds; marine biota; chemistry and microbiology; species, habitats and processes sensitive to OCS development; trophic interactions, probable impacts and consequences of oil development; effects of gravel mining and construction of gravel mining and construction of gravel islands and causeways; and environmental hazards to offshore operations of the Beaufort and the Chukchi Seas before the development of petroleum and related resources were undertaken. GRA

N79-20545# Oak Ridge National Lab., Tenn.

REVIEWS OF THE ENVIRONMENTAL EFFECTS OF POLLUTANTS. 5: CYANIDE Final Report

Leigh E. Towill, John S. Drury, Brad L. Whitfield, Eric B. Lewis, Elizabeth L. Galyan, and Anna S. Hammons Oct. 1978 206 p refs Sponsored by DOE and EPA

(PB-289920/1; ORNL/EIS-81; EPA-600/1-78-027) Avail: NTIS HC A10/MF A01 CSCL 06T

A review is given of the scientific literature on the biological and environmental effects of cyanide. Included in the review are a general summary and a comprehensive discussion of the following topics as related to cyanide and specific cyanide compounds: physical and chemical properties; occurrence; synthesis and use; analytical methodology; biological aspects in microorganisms, plants, wild and domestic animals, and humans; distribution, mobility, and persistence in the environment; assessment of present and potential health and environmental hazards; and review of standards and governmental regulations. GRA

N79-20546# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.

EMISSION INVENTOR/FACTORY WORKSHOP, VOLUME 1 Final Proceedings Report

May 1978 20338 p refs Workshop held at Raleigh, N. C., 13-15 Sep. 1977 2 Vol.

(PB-289122/4; EPA-450/3-78-042A-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 13B

The presentations made at the Emission Inventory and Factor Workshop in Raleigh, N.C. September 13-15, 1977 are presented. A total of twenty-five papers on emission inventory and factor experiences and other information with emphasis on organics (hydrocarbons) are discussed. GRA

N79-20547# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.

EMISSION INVENTORY/FACTORY WORKSHOP, VOLUME 2 Final Proceedings Report

May 1978 410 p refs Workshop held at Raleigh, N. C., 13-15 Sep. 1977 2 Vol.

(PB-289123/2; EPA-450/3-78-042B-Vol-2) Avail: NTIS HC A18/MF A01 CSCL 13B

Presentations made at the Emission Inventory and Factor Workshop in Raleigh, N.C., September 13-15, 1977 are summarized. A total of twenty-five papers on emission inventory and factor experiences and other information with emphasis on organic (hydrocarbons) were presented. Authors represented EPA, state air pollution control agencies and private industry. GRA

N79-20548# Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.

HARRY'S BROOK: A SURVEILLANCE REPORT OF PHYSICAL CONDITIONS AND BIOLOGICAL HEALTH

William Whipple, Jr., Alan W. McIntosh, and James M. DiLouie Sep. 1978 42 p refs

(Contract DI-14-34-0001-8032)

(PB-289489/7; W79-01907; OWRT-A-048-NJ(4)) Avail: NTIS HC A03/MF A01 CSCL 13B

Streams in urbanizing areas were subject to a variety of stresses produced by the processes of growth; most of the resulting changes were environmentally adverse. Unfortunately, small streams were so numerous and conditions in them may change so rapidly that conventional monitoring network cannot deal with them. The condition of these streams may be more accurately monitored by biological evaluations than by measurements of the usual water quality parameters. A surveillance of Harry's Brook in Princeton Township, New Jersey was conducted to evaluate the biological health of the stream, the pollution

sources to which it is subject and certain other physical conditions relevant to management. GRA

N79-20549# Environmental Protection Agency, Chicago, Ill.
VOLUNTARY AND REGULATORY APPROACHES FOR NONPOINT SOURCE POLLUTION CONTROL (WATER QUALITY PLANNING)
Ralph G. Christensen, comp. and Carl D. Wilson, comp. Aug. 1978 231 p refs Conf. held at Rosemont, Ill., 23-24 May 1978
(PB-289411/1; EPA-905/9-78-001) Avail: NTIS HC A11/MF A01 CSCL 13B

Investigated studies included: water quality data, sediment and erosion data, land management practices (used on projects to evaluate impact on water quality educational programs to inform the public on nonpoint source problems), and institutional arrangements that were used to implement nonpoint source pollution controls. GRA

N79-20550# Alaska Univ., Fairbanks. Inst. of Water Resources.
EFFECTS OF THERMAL DISCHARGE UPON A SUBARCTIC STREAM
Robert F. Carlson, Timothy Tilsworth, and Charlotte Hok Jun. 1978 69 p refs Sponsored in part by DI
(PB-289369/1; WR-49; W79-01898; OWRT-B-020-ALAS(1))
Avail: NTIS HC A04/MF A01 CSCL 13B

The Fairbanks Municipal Utilities System power plant uses the Chena River, a subarctic stream, as its primary cooling water discharge source. The heated discharge has a number of effects, the most notable of which is the creation of an extensive downstream open water section during the winter when the river is normally ice covered. GRA

N79-20551# Arkansas Univ., Fayetteville. Water Resources Research Center.
A PRELIMINARY ECOLOGICAL SURVEY OF DARDANELLE RESERVOIR PRIOR TO NUCLEAR FACILITY EFFLUENT DISCHARGE
Clarence B. Sinclair and Robert L. Watson 1978 56 p refs
(PB-289236/2; PUB-60; W79-01591; OWRT-A-012-ARK(1))
Avail: NTIS HC A04/MF A01 CSCL 13B

A preliminary ecological survey of Dardanelle Reservoir during the construction phase of Ark. Power and Light Company's nuclear generating facility was conducted from Jan. 1970 - June 1974. The reservoir is characterized by relatively shallow depths and a high flow-thru rate. The reservoir carried a great deal of suspended materials and exhibited high turbidities throughout most of the year. Typical thermal stratification and oxygen depletion were only rarely observed. Many of the physicochemical parameters exhibited relatively high values in comparison to other Arkansas lakes and reservoirs, but due to absence of prolonged periods of stratification, they did not undergo the extreme fluctuations sometimes observed in other reservoirs. GRA

N79-20426*# Directorate of Energy Management, Kelly AFB, Tex. Quality Div.
POTENTIAL OF A NITROGEN TETROXIDE SPILL OR EMISSION DURING MOVEMENT FROM SUPPLIER TO USER
Wilbur F. Watje *In* NASA. Kennedy Space Center Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 11-22 (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 13B

N79-20427*# Florida Inst. of Tech., Melbourne. Medical Research Inst.
SCRUBBING LIQUORS FOR NITROGEN TETROXIDE
John J. Thomas *In* NASA. Kennedy Space Center Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 23-60 (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 13B

N79-20428*# Florida Inst. of Tech., Melbourne. Dept. of Mechanical Engineering.
ESTIMATED SHUTTLE LOADING EMISSIONS
Thomas E. Bowman *In* NASA. Kennedy Space Center Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 61-84 ref (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 13B

N79-20429*# Martin Marietta Corp., Denver, Colo. Engineering Propulsion Lab.
NITROGEN TETROXIDE VAPOR SCRUBBER USING A RECIRCULATING LIQUID
T. D. Reisert *In* NASA. Kennedy Space Center Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 85-110 ref (For primary document see N79-20424 11-42)
(Contract NAS10-9095)
Avail: NTIS HC A10/MF A01 CSCL 13B

N79-20431*# Florida Inst. of Tech., Melbourne. Medical Research Inst.
ULTIMATE DISPOSAL OF SCRUBBER WASTES
Bernard C. Cohenour *In* NASA. Kennedy Space Center Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 131-158 (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 13B

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N79-20552*# National Aeronautics and Space Administration, Washington, D. C.
INTERNAL GRAVITY WAVES IN THE UPPER ATMOSPHERE, GENERATED BY TROPOSPHERIC JET STREAMS
Ye. P. Chunchuzov and Yu. M. Torgashin Mar. 1979 12 p refs Transl. into ENGLISH from Polar. Siyaniya Svechenie Nochnogo Neba (Moscow), no. 27, 1978 p 13-17 Original language document was announced as A79-11721 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75407) Avail: NTIS HC A02/MF A01 CSCL 04A

A mechanism of internal gravity wave generation by jet streams in the troposphere is considered. Evaluations of the energy and pulse of internal gravity waves emitted into the upper atmosphere are given. The obtained values of flows can influence the thermal and dynamic regime of these layers. Author

N79-20553*# National Aeronautics and Space Administration, Washington, D. C.
MULTICOMPONENT DIFFUSION AND ENERGY CHARACTERISTICS OF PARTIALLY IONIZED PLASMA IN THE IONOSPHERE OF A PLANET
M. A. Marov and A. V. Kolesnichenko Feb. 1979 41 p refs Transl. into ENGLISH of "Mnogokomponentnaya Diffuziya i Energetika Chastichnoionizovannoy Plazmy Ionosfery Planety", Rept. Preprint-123 Keldysh Inst. of Appl. Math. of the USSR Acad. of Sci., Moscow, 1978 p 1-32 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75409; Preprint-123) Avail: NTIS HC A03/MF A01 CSCL 04A

The problem of energy and multicomponent ambipolar diffusion of plasma in the lower ionosphere of a planet with a weak magnetic field is considered. G.Y.

N79-20554*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF THE MEASUREMENT OF THE VERTICAL PROFILE OF OZONE UP TO A HEIGHT OF 70 km BY MEANS OF THE MR-12 AND M-100 SOUNDING ROCKETS
N. I. Brezgin, G. I. Kuznetsov, A. F. Chizhov, and O. V. Shtyrkov Mar. 1979 12 p refs Transl. into ENGLISH from Meteorol. Issled. (USSR), no. 23, 1977 p 30-35 Original language

document was announced as A78-38455 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-75380) Avail: NTIS HC A02/MF A01 CSCL 04A

The photometers used and methods of calculation of the vertical ozone concentration profile are described. The results obtained in several series of MR-12 and M-100 sounding rocket launchings are presented and discussed. Author

N79-20555*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A SYSTEM FOR PLOTTING SUBSOIL STRUCTURE AND METHOD THEREFOR Patent Application
Keshavaiyengar Y. Narashimhan (JPL), Shakkottai P. Parthasarathy (JPL), and Robert Nathan, inventors (to NASA) (JPL) Filed 6 Sep. 1977 19 p Sponsored by NASA
(NASA-Case-NPO-14191-1; US-Patent-Appl-SN-830846) Avail: NTIS HC A02/MF A01 CSCL 08G

Data for use in producing a tomograph of subsoil structure between boreholes is derived by placing spaced geophones in one borehole, and if desired also on the earth surface, and by producing a sequence of shots at spaced apart locations in the other borehole. The signals, detected by each of the geophones from the various shots, are processed either on a time of arrival basis, or on the basis of signal amplitude, to provide information of the characteristics of a large number of incremental areas (pixels) between the boreholes. Such information is useable to produce a tomograph of the subsoil structure between the boreholes. NASA

N79-20556*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A SYSTEM FOR DETECTING SUBSTRUCTURE MICRO-FRACTURES AND METHOD THEREFOR Patent Application.
Shakkottai P. Parthasarathy (JPL) and Keschavaiyengar Y. Narashimhan, inventors (to NASA) (JPL) Filed 6 Sep. 1977 13 p Sponsored by NASA
(NASA-Case-NPO-14192-1; US-Patent-Appl-SN-830562) Avail: NTIS HC A02/MF A01 CSCL 08G

A system to determine substructure permeability is described. Bursts of signals at different frequencies are induced into substructure, adjacent a borehole. The return signals from each burst of signals are normalized to compensate for the attenuation, experienced by more distant return signals. The peak amplitudes of return signals, above a selected level, are cut off, and an average signal is produced from the normalized amplitude-limited return signals of each burst. The averaged signals of the return signals of all the signal bursts at the different frequencies are processed, to provide a combined signal, whose amplitude is related to the microfracture density of the substructure adjacent to the borehole. Author

N79-20557*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GEOPHYSICAL ATLAS FOR INTERPRETATION OF SATELLITE-DERIVED DATA
Paul D. Lowman, Jr., ed., Herbert V. Frey, ed., W. M. Davis (Albany Global Tectonics Group), A. P. Greenberg (Albany Global Tectonics Group), M. K. Hutchinson (Albany Global Tectonics Group), R. A. Langel (Albany Global Tectonics Group), B. E. Lowrey (Albany Global Tectonics Group), J. G. Marsh (Albany Gobal Tectonics Group), G. D. Mead (Albany Global Tectonics Group), and J. A. OKeefe (Albany Global Tectonics Group) Feb. 1979 60 p refs
(NASA-TM-79722) Avail: NTIS HC A04/MF A01 CSCL 08G

A compilation of maps of global geophysical and geological data plotted on a common scale and projection is presented. The maps include satellite gravity, magnetic, seismic, volcanic, tectonic activity, and mantle velocity anomaly data. The Bibliographic references for all maps are included. G.Y.

N79-20558*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE RELAYING OF GEOPHYSICAL DATA
Richard J. Allenby Nov. 1977 25 p refs Submitted for publication
(NASA-TM-80260; X-922-77-273) Avail: NTIS HC A02/MF A01 CSCL 08G

Data Collection Platforms (DCPs) for transmitting surface data to an orbiting satellite for relaying to a central data distribution center are being used in a number of geophysical applications. 'Off-the-shelf' DCP's, transmitting through Landsat or GOES satellites, are fully capable of relaying data from low-data-rate instruments, such as tiltmeters or tide gauges. In cooperation with the Lamont-Doherty Geological Observatory, Goddard has successfully installed DCP systems on a tide gauge and tiltmeter array on Anegada, British Virgin Islands. Because of the high-data-rate requirements, a practical relay system capable of handling seismic information is not yet available. Such a system could become the basis of an operational hazard prediction system for reducing losses due to major natural catastrophies such as earthquakes, volcanic eruptions, landslides or tsunamis. Author

N79-20559*# New Hampshire Univ., Durham. Space Science Center.
INVESTIGATION OF ELECTRICAL CURRENTS IN THE AURORAL IONOSPHERE Final Report, 1 Jul. 1976 - 31 Dec. 1978
R. L. Arnoldy 1978 25 p refs
(Grant NsG-6013)
(NASA-CR-158444) Avail: NTIS HC A02/MF A01 CSCL 04A

Two papers are presented on the investigation of electrical currents in the auroral ionosphere: (1) The Relationship Between Field-Aligned Current Carried by Suprathermal Electrons, and the Auroral Arc; and (2) Ionospheric Electrical Currents in the Late Evening Plasma Flow Reversal. In the first paper (1), data from four auroral sounding rockets, which directly measured field-aligned currents with partical detectors, are presented. In the second paper (2), data are presented for an instrumented sounding rocket that was launched from Andoya, Norway in January 1977, in the late evening auroral oval. G.Y.

N79-20560# Michigan Technological Univ., Houghton. Dept. of Civil Engineering.
INCREASING THE EFFECTIVENESS OF SOIL COMPACTION AT BELOW-FREEZING TEMPERATURES
Wilbur M. Haas, Bernard D. Alkire, and Thomas J. Kaderabek Nov. 1978 68 p refs
(Grant DA-ENG-27021-73-G43)
(AD-A062875; CRREL-SR-78-25) Avail: NTIS HC A04/MF A01 CSCL 08/13

This report presents data from an experimental program undertaken to determine the effect of low temperatures on the compaction characteristics of a silty sand. The effects of compactive effort and chemical additives were also investigated to determine possible methods of improving the densities of soils placed and compacted at low temperatures. A single soil type was used throughout the test program and test results were obtained using Standard and Modified AASHO compactive efforts on an untreated soil prepared and tested at temperatures of 20C and -7C. Additional test series, using the same compactive efforts and temperatures, were performed on the soil after it had been treated with an additive. The amounts of additive used, based on the dry weight of soil, were 3, 2, 1, 0.5, and 0.25% of calcium chloride and 0.5% of sodium chloride. From the results of the experimental program, several important conclusions concerning the effect of low temperature compaction were drawn: (1) For similar test conditions, the dry unit weight of a frozen compacted soil is less than for an unfrozen compacted soil. (2) The dry unit weight of a frozen soil is inversely proportional to the amount of ice in the soil pore space. (3) Chemical additives can be effectively used to offset the adverse effect of low temperature on the compaction characteristics of a soil. (4) The effect of chemical additives on the compaction characteristics of a soil compacted at temperatures below 0C can be predicted using phase equilibrium concepts from physical chemistry. GRA

N79-20561# Denver Univ., Colo. Dept. of Physics.
INFRARED BACKGROUND MEASUREMENT Final Report, 15 Dec. 1976 - 30 Jun. 1978
D. G. Murcray, F. H. Murcray, F. J. Murcray, and W. J. William Sep. 1978 26 p
(Contract F19628-77-C-0016)
(AD-A062260; AFGL-TR-78-0249) Avail: NTIS

HC A03/MF A01 CSCL 04/1

The objective of this program was to measure the background radiance of the earth and its limb in the infrared from high altitude. Two types of measurements were to be made: high resolution spectral measurements using an interferometer system and moderate resolution measurements, particularly in the 4.3 micrometer and 15 micrometer region, using filter radiometers. The high resolution data were to be obtained by means of a liquid-nitrogen-cooled total containment interferometer system which was to be government-furnished equipment. This instrument was not delivered during the program hence, no data were obtained. Two filter radiometers were flown on the stratcom VIII b1. Data obtained with the 682.3CM-1 unit are presented and compared with the radiant temperatures determined from the rawinsonde runs. GRA

N79-20562# Analytics, Inc., Willow Grove, Pa.
BREADBOARD DROPSONDE-MINIREFRACTIONSONDE ANALYZER, VOLUME 1 Final Report, 23 Dec. 1976 - 22 Nov. 1978
Mervin C. Werst 22 Nov. 1978 286 p
(Contract N62269-77-C-0095)
(AD-A062397; NADC-76335-30-Vol-1) Avail: NTIS
HC A13/MF A01 CSCL 04/1

The Breadboard Dropsonde-Minirefractionsonde Analyzer can be used for analysis of three different types of soundings: (1) Dropsonde with baroswitch pressure sensor, (2) Dropsonde with continuous analog pressure sensor (CAPS), and (3) Balloon-borne minirefractionsonde (with CAPS). The equipment complement of the system is the same for analyzing all three types of soundings. The one exception is that the EECO Paper Tape Reader is not used in analyzing soundings using the CAPS dropsonde and the minirefractionsonde. The three types of analysis are accommodated by simply using a different program to control the processing. The Breadboard Dropsonde-Minirefractionsonde Analyzer's design and development are based partially on principles that were implemented and shown feasible in the Engineering Prototype Processor that was developed by Analytics for NADC (Contract No. N62269-75-C-0382 -- Technical Report 1167, An Engineering Prototype Processor Incorporating Data for Refractive Index Profiles). GRA

N79-20563# Alaska Univ., Fairbanks. Inst. of Marine Science.
GASES IN THE SEA ICE Annual Report, 10 Oct. 1977 - 31 Sep. 1978
Thomas A. Gosink and John J. Kelley Sep. 1978 100 p refs
(Contract N00014-76-C-0331)
(AD-A062096) Avail: NTIS HC A05/MF A01 CSCL 08/12

The overall research at NRL for gases in sea ice is getting to be complex in the number of different tasks that need to be addressed. Furthermore, we have extended help to other ONR supported programs and have received cooperation from them. The two principal programs are MIZMEX (Kelly-Hanson at NRL) and the Arctic Aerosol Program (Rahn/Shaw at U.R.I. and U of A). The plan is given in Appendix A, and the topic will be treated in that order in this report. GRA

N79-20564# SRI International Corp., Menlo Park, Calif.
ON THE INTERPRETATION OF IONOSPHERIC SCINTILLATION DATA USING A POWER-LAW PHASE SCREEN MODEL: WEAK SCATTER Topical Report No. 2, 1 Jun. 1977 - 28 Feb. 1978
Charles L. Rino and Stephen J. Matthews Feb. 1978 61 p refs
(Contract DNA001-77-C-0220; SRI Proj. 6434)
(AD-A062333; AD-E300389; DNA-4606T) Avail: NTIS
HC A04/MF A01 CSCL 04/1

An equivalent phase screen model is used to interpret the Wideband satellite data under conditions of weak scattering where the intensity scintillation is such that S sub 4 is - or approximately 0.4. The phase spectral density is fitted to a power-law model of the form TF(to the -p power) to obtain the basic parameters T and p. The phase screen model is then used to remove the geometrical dependence of T. An invariant strength-of-turbulence parameter can be obtained from such an analysis. By using the phase-screen model, the Wideband rms phase and intensity data have been self-consistently calculated, thereby verifying the validity of the model. The results are used to calculate the rms electron density perturbation levels required to produce significant gigahertz scintillation. Author (GRA)

N79-20565# Australian National Univ., Canberra. Research School of Earth Sciences.
RESEARCH ON LINEAR AND NONLINEAR ATMOSPHERIC WAVES Final Scientific Report, 1 Aug. 1978
D. R. Christie, K. J. Muirhead, and A. L. Hales 1 Aug. 1978 171 p refs
(Grant AF-AFOSR-2759-75)
(AD-A062567; AFOSR-78-1642TR) Avail: NTIS
HC A08/MF A01 CSCL 04/1

In this report the results of a three-yeer study of linear and nonlinear waves in the atmosphere based on an experimental program at the Warramunga Seismic Station located at 19 deg. 56 min S near Tennant Creek in the Northern Territory of Australia are reviewed. The first section of the report provides a brief description of the installation of the infrasonic arrays, the acoustic sounding system, the array-associated meteorological instrumentation, the data acquisition system and the digital time series analysis techniques. The second section outlines the basic studies of four separate classes of atmospheric wave phenomena. First, a description is given of the discovery of three fundamentally different types of atmospheric solitary waves. Secondly, the results and implications of a study of the evolutionary properties of a new form of soliton-generating propagating disturbance in the lower troposphere are presented. The third investigation is concerned with a study of the characteristics of acoustic microbarom radiation in the Southern Hemisphere with regard to a determination of the equatorial structure of the stratosphere and lower thermosphere. Finally, an outline is given of the research into the origin of nonlinear long-period irregular atmospheric gravity waves. In the appendices of this report two separate papers which detail the studies of solitary atmospheric waves and soliton-generating intrusive disturbances are presented.
Author (GRA)

N79-20566# Logicon, Inc., Lexington, Mass.
RESEARCH, ANALYSIS, DEVELOPMENT, AND APPLICATION OF HIGHLY INTEGRATED SYSTEMS OF MULTI-PHASES OF THE PHYSICS OF THE UPPER ATMOSPHERE Final Report, 15 Jan. - 15 Jul. 1978
James N. Bass, Krishin H. Bhavnani, Shu T. Lai, Frank R. Roberts, and Donna L. Piegelman 15 Oct. 1978 210 p refs
(Contract F19628-78-C-0049)
(AD-A062488; AFGL-TR-78-0204) Avail: NTIS
HC A10/MF A01 CSCL 04/1

A variety of computer programs is used to fulfill the different requirements, generated by the various research programs, for satellite orbit data. Revisions to these programs are presented which, variously, enlarge the input/output capabilities, improve the accuracy of calculations, or extend the range of problems that can be addressed. Results are presented of investigations of the comparative accuracy of available programs for satellite orbit prediction and solar ephemeris calculation. Occasionally large scale computer codes useful for geophysical analyses, but developed elsewhere, must be adapted to the needs of AFGL research programs and modified for use on the 6600 system. Cases in point are a code for predicting the proton and electron environments in the magnetosphere and another for transforming between geomagnetic and geographical coordinate systems. Modifications to these programs and procedures for their operational usage are presented. Atmospheric density modeling plays an important role in satellite orbit determination. Results are presented for efforts to: incoporate new density models into orbit determination programs; evaluate the performance of different density models in orbit determination applications; and provide methods for model development by applying multiple regression to experimental data. GRA

N79-20567# Oklahoma State Univ., Stillwater. Electronics Lab.
ROCKET INSTRUMENTATION SUPPORT SERVICES Final Report, 1 Feb. 1975 - 31 Jul. 1978
Richard F. Buck, R. Michael Fike, and Claude M. Gwinn 31 Aug. 1978 199 p refs
(Contract F19628-75-C-0084)

(AD-A062472; AFGL-TR-78-02) Avail: NTIS HC A09/MF A01 CSCL 04/1

This report summarizes the services supplied to the Air Force Geophysics Laboratories in support of the upper air research program. Personnel and equipment were supplied at a number of launch sites. Descriptions of airborne payload equipment and special ground support equipment are presented. Airborne equipment included telemetry and related apparatus, including both analog and digital systems. Ground support equipment included autotrack and manual antennas, trajectory determination systems, and PCM decoding systems. Author (GRA)

N79-20568# General Electric Co., Philadelphia, Pa. Space Div.

DEFENSE NUCLEAR AGENCY REACTION RATE HANDBOOK, SECOND EDITION, REVISION NUMBER 7

Marlyn H. Bortner and Theodore Baurer Mar. 1978 78 p Revised

(Contracts DNA001-78-C-0040; DNA001-75-C-0023)

(AD-A062474; DNA-1948H-Rev-7) Avail: NTIS HC A05/MF A01 CSCL 04/1

This chapter presents a tabulated summary of reactions, with suggested rate coefficients, relevant to the problems of atmospheric chemical recovery following a perturbation. The present generation of computers permits the convenient handling of large numbers of reactions in the solution of such problems. Thus, one can now include in detailed calculations of this type hundreds of individual reactions and follow the complete histories of large numbers of individual species as atmospheric constituents. Many computer codes exist which have been designed for the study of atmospheric systems, and which are capable of carrying out the appropriate calculations. GRA

N79-20569# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

EFFECTS OF PARTICULATE COMPLEX REFRACTIVE INDEX AND PARTICLE SIZE DISTRIBUTION VARIATIONS ON ATMOSPHERIC EXTINCTION AND ABSORPTION FOR VISIBLE THROUGH MIDDLE-INFRARED WAVELENGTHS

S. G. Jennings and R. G. Pinnick Sep. 1978 60 p refs

(DA Proj. 1L1-61102-B-53A)

(AD-A062667; ERADCOM/ASL-TR-0016) Avail: NTIS HC A04/MF A01 CSCL 17/5

The results of calculations are presented in tabulated and graphical form. A sensitivity analysis intended to determine how atmospheric aerosols, over a wide range of size parameters and complex refractive index values, limit the battlefield effectiveness of military electro-optical surveillance, target designators, and communications systems is reported. J.M.S.

N79-20570# Arcon Corp., Waltham, Mass.

IONOSPHERIC MODELING AND PROPAGATION ANALYSIS Interim Report, Nov. 1976 - Oct. 1977

David C. Miller and Joseph Gibbs Griffiss AFB, N. Y. RADC Jul. 1978 93 p refs

(Contract F19628-77-C-0051; AF Proj. 2305)

(AD-A062998; RADC-TR-78-163; SCIENTIFIC-1) Avail: NTIS HC A05/MF A01 CSCL 04/1

This report describes several studies performed toward improving our knowledge of the properties of high-frequency communication circuits. These studies included the development of three dimensional electron density models and the analysis of various propagation modes in the ionosphere. Several vertical electron density models were constructed that proved to be useful in both global and polar region HF applications. Improvements were made to existing models for individual ionospheric layer parameters. Some of the properties of long range ducted modes have been isolated using ray tracing techniques. The relative probability of establishing and maintaining ducted modes as a function of the HF circuit parameters for various ionospheric conditions has been explored. The stability of these modes for small perturbations to the ambient ionosphere has also been studied. Injection into ionospheric ducts by artifically heating localized regions of the ionosphere has been investigated. Spatial distributions and intensity patterns have been obtained for irregularities in the electron density which align themselves with the local geomagnetic field. GRA

N79-20151*# National Environmental Satellite Service, Washington, D. C.

THE EARTH RADIATION BUDGET (ERB) EXPERIMENT

H. Jacobowitz, L. L. Stowe, and J. R. Hickey (Eppley Lab., Inc.) *In* NASA. Goddard Space Flight Center The Nimbus 7 User's Guide Aug. 1978 p 33-58 (For primary document see N79-20148 11-12)

Avail: NTIS HC A14/MF A01 CSCL 04A

N79-20152*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE LIMB INFRARED MONITOR OF THE STRATOSPHERE (LIMS) EXPERIMENT

J. M. Russell and J. C. Gille (Natl. Center for Atmospheric Res., Boulder, Colo.) *In* NASA. Goddard Space Flight Center The Nimbus 7 User's Guide Aug. 1978 p 71-104 Sponsored in part by NSF (For primary document see N79-20148 11-12)

Avail: NTIS HC A14/MF A01 CSCL 04A

N79-20153*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

STRATOSPHERIC AEROSOL MEASUREMENT (SAM 2) EXPERIMENT

M. P. McCormick, L. E. Mauldin, III, L. R. McMasters, W. P. Chu, and T. Swissler (Systems and Appl. Sci. Corp., Hampton, Va.) *In* NASA. Goddard Space Flight Center The Nimbus 7 User's Guide Aug. 1978 p 105-138 (For primary document see N79-20148 11-12)

Avail: NTIS HC A14/MF A01 CSCL 04A

N79-20154*# Oxford Univ. (England). Dept. of Atmospheric Physics.

THE STRATOSPHERIC AND MESOSPHERIC SOUNDER (SAMS) EXPERIMENT

J. R. Drummond, J. T. Houghton, G. D. Peskett, C. D. Rodgers, M. J. Wale, J. Whitney, and E. J. Williamson *In* NASA. Goddard Space Flight Center The Nimbus 7 User's Guide Aug. 1978 p 139-174 ref (For primary document see N79-20148 11-12)

Avail: NTIS HC A14/MF A01 CSCL 04A

N79-20976# European Space Agency, Paris (France).

ANALYSIS OF A LAMBERTIAN TYPE EMISSION FROM A SPHERICAL SURFACE

Christian Marchal *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-2 (ESA-TT-496) Nov. 1978 p 15-25 ref Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-2, Mar.-Apr. 1978 p 59-64 Original report in FRENCH previously announced as A76-38697 (For primary document see N79-20974 11-99)

Avail: NTIS HC A05/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N79-20571 Nevada Univ., Reno.

AN APPLICATION OF TELFORD'S STOCHASTIC MODEL OF CLOUD DROPLET COALESCENCE TO THE ONSET OF DRIZZLE IN STRATUS FOGS Ph.D. Thesis

Chong Yuan Chen 1978 148 p

Avail: Univ. Microfilms Order No. 7906132

The onset of drizzle was defined as the moment when 0.000001/cu cm of cloud drops grow to 40 microns in radius. An estimate of the range of validity of Telford's model as an approximation to the calculation of the kinetic equation was developed before applying the Telford model to the realistic cases of the onset of drizzle. A special numerical method was developed to solve the kinetic equation. Six cases of initial conditions are used for the calculation of growth time and fog depth required to form drizzle, and the variation of spectra is given in both time and vertical height. The work can be applied in other fields such as the coagulation of aerosols, the modification of fogs and the scavenging of air pollution by precipitation.

Dissert. Abstr.

N79-20572*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODE 1 CRACK SURFACE DISPLACEMENTS FOR A ROUND COMPACT SPECIMEN SUBJECT TO A COUPLE AND FORCE
Bernard Gross 1979 13 p refs Presented at the 12th Natl. Symp. on Fracture Mech., St. Louis, 21-23 May 1979; sponsored in part by the Am. Soc. for Testing and Mater.
(NASA-TM-79096; E-9920) Avail: NTIS HC A02/MF A01 CSCL 04B

Mode I displacement coefficients along the crack surface are presented for a radially cracked round compact specimen, treated as a plane elastostatic problem, subjected to two types of loading; a uniform tensile stress and a nominal bending stress distribution across the net section. By superposition the resultant displacement coefficient or the corresponding influence coefficient can be obtained for any practical load location. Load line displacements are presented for A/D ratios ranging from 0.40 to 0.95, where A is the crack length measured from the crack mouth to the crack tip and D is the specimen diameter. Through a linear extrapolation procedure crack mouth displacements are also obtained. Experimental evidence shows that the results are valid over the range of A/D ratios analyzed for a practical pin loaded round compact specimen. J.M.S.

N79-20573*# Federal Electric Corp., Cocoa Beach, Fla. RF Systems Branch.
MEASURED ELECTRIC FIELD INTENSITIES NEAR ELECTRIC CLOUD DISCHARGES DETECTED BY THE KENNEDY SPACE CENTER'S LIGHTNING DETECTION AND RANGING SYSTEM, LDAR
Horst A. Poehler Feb. 1977 47 p refs
(Contract NAS10-4967)
(NASA-CR-154630; FEC-720-7154) Avail: NTIS HC A03/MF A01 CSCL 04B

For a summer thunderstorm, for which simultaneous, airborne electric field measurements and Lightning Detection and Ranging (LDAR) System data was available, measurements were coordinated to present a picture of the electric field intensity near cloud electrical discharges detected by the LDAR System. Radar precipitation echos from NOAA's 10 cm weather radar and measured airborne electric field intensities were superimposed on LDAR PPI plots to present a coordinated data picture of thunderstorm activity. G.Y.

N79-20574*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMPACT OF SHORT INTERVAL SMS DIGITAL DATA ON WIND VECTOR DETERMINATION FOR A SEVERE LOCAL STORMS AREA
Cynthia A. Peslen Feb. 1979 29 p refs Submitted for publication
(NASA-TM-79714) Avail: NTIS HC A03/MF A01 CSCL 04B

The impact of 5 minute interval SMS-2 visible digital image data in analyzing severe local storms is examined using wind vectors derived from cloud tracking on time lapsed sequence of geosynchronous satellite images. The cloud tracking areas are located in the Central Plains, where on 6 May 1975, hail-producing thunderstorms occurred ahead of a well defined dry line. The results demonstrate that satellite-derived wind vectors and their associated divergence fields complement conventional meteorological analyses in describing the conditions preceding severe local storm development. Author

N79-20575*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THIRD NATIONAL AERONAUTICS AND SPACE ADMINISTRATION WEATHER AND CLIMATE PROGRAM SCIENCE REVIEW
Earl R. Kreins, ed. 1977 304 p refs Proc. held at Greenbelt, Md., 29-30 Nov. 1977
(NASA-CP-2029) Avail: NTIS HC A14/MF A01 CSCL 04B

Research results of developing experimental and prototype operational systems, sensors, and space facilities for monitoring, and understanding the atmosphere are reported. Major aspects include: (1) detection, monitoring, and prediction of severe storms; (2) improvement of global forecasting; and (3) monitoring and prediction of climate change. For individual titles, see N79-20576 through N79-20632.

N79-20576*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DRY AIR ENTRAINMENT INTO CONVECTIVE CLOUDS
J. Telford (Effective Concepts Inc.) *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 1-6 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

A systematic approach to the study of atmospheric turbulent motion is discussed in terms of weather modification. The background of cloud physics, and the mixing process are described. A zero-g study is proposed to enable the basic experimental data to be collected so that theory may be developed to generalize results for practical applications. F.O.S.

N79-20577*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THREE DIMENSIONAL CLOUD TOP CHANGES RELATED TO THUNDERSTORM SEVERITY
Robert F. Adler *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 7-10 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Digital infrared data from a geostationary satellite are used to study thunderstorm top growth rates and other parameters in relation to the occurrence of severe weather on the ground. Both the rate of upward growth of the thunderstorm top and the maximum height reached are shown to be useful parameters in the detection of severe thunderstorms. Author

N79-20578*# Alabama Univ., Huntsville.
DETECTION OF SEVERE STORMS THROUGH A TROPOSPHERIC-IONOSPHERIC COUPLING MECHANISM
R. J. Hung and R. E. Smith (NASA. Marshall Space Flight Center) *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 11-15 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Acoustic-gravity waves were detected by a ground-based ionospheric sounding array, and the location of the wave generation source was determined by a reverse group ray path computation. Computed sources of these waves were located near locations where tornadoes touched down from 2 to 4 hours later. It is suggested that the overshooting and ensuing collapse of convective turrets may be responsible for generating the acoustic-gravity waves observed. Author

N79-20579*# Chicago Univ., Ill.
MESOANALYSIS OF RECORD CHICAGO RAINSTORM USING RADAR, SATELLITE, AND RAIN-GAGE DATA
T. Theodore Fujita *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 17-21 (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Comparison of cloud-top topography and rainfall rates at the surface revealed that the areas of heavy rain are located where there are depressions at the anvil top. It was also found that the Z-R relationships show a large scatter when vertical and/or horizontal air currents are strong. Results of this research led to Project NIMROD proposed to begin in May 1978. Author

N79-20580*# Texas A&M Univ., College Station.
SEVERE STORMS AND THEIR INTERACTION WITH THE ENVIRONMENT
James R. Scoggins *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 23-27 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

A brief description is given of significant research accomplishments and of planned research on atmospheric variability and the interaction of severe storms with their environment using atmospheric variability experiments data. Use of the results for the assessment of satellite capabilities are described briefly.
Author

N79-20581*# George Washington Univ., Washington, D. C.
A REAL-TIME SUBSYNOPTIC, MESO, AND MICROSCALE SEVERE STORM FORECAST SYSTEM
M. L. Kaplan *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 29-33 (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

A system of differential equations is integrated numerically in space and time over several different matrices in an effort to simulate the atmospheric wave structures which organize severe local storms. Preliminary results with case studies indicate that dynamical fields produced by the numerical simulations can be translated into very fine scale space and time zones where severe storm forecast indices can be developed. These fine scale indices are now available in real-time when run on Langley's STAR 100 computer system. Author

N79-20582*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LATENT HEAT CALCULATIONS AND THEIR RELATIONSHIP TO TROPICAL CYCLONE INTENSITY
Robert F. Adler *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 35-39 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Data from the Nimbus-5 electrically scanning microwave radiometer (ESMR) were used to calculate total storm latent heat release (LHR) and other precipitation parameters for over 100 satellite observations of Pacific Ocean tropical cyclones. The data are useful in determining the rainfall characteristics of these storms and appear to be potentially useful in monitoring them. F.O.S.

N79-20583*# General Electric Co., Beltsville, Md.
CLOUD TEMPERATURES AND PREDICTION OF HURRICANE INTENSITY
R. Cecil Gentry, Joseph Steranka, Edward B. Rodgers (NASA. Goddard Space Flight Center), and William E. Shenk (NASA. Goddard Space Flight Center) *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 41-45 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Equivalent black body temperatures of clouds around tropical cyclones are used in a statistical technique to forecast changes in maximum winds for 24 hours in advance. Author

N79-20584*# ADAPT Service Corp., Reading, Mass.
OBJECTIVE TROPICAL CYCLONE ANALYSIS AND FORECASTING TECHNIQUE USING CONVENTIONAL AND NIMBUS-5 ELECTRICALLY SCANNING MICROWAVE RADIOMETER MEASUREMENTS
H. E. Hunter, E. B. Rodgers (NASA. Goddard Space Flight Center), and W. E. Shenk (NASA. Goddard Space Flight Center) *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 47-50 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

The ADAPT empirical analysis programs, based on finding an optimal representation of the data in the Karhunen-Loeve sense, were applied to 120 observations of twenty-nine 1973 and 1974 Pacific tropical cyclones. Each observation consists of NIMBUS-5 electrically scanning microwave radiometer (ESMR) radiation measurements at 267 grid points covering and surrounding the tropical cyclone plus nine other non-satellite derived descriptors. Analysis and forecast algorithms to estimate storm motion and intensity were developed for times ranging from the observation time up to 72 hours later. The 24 hr wind speed forecasts with an accuracy of 11.7 knots and position forecasts with accuracies 15% better than persistence were demonstrated using independent tests. F.O.S.

N79-20585*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REMOTE SENSING OF HURRICANE WAVES
David B. King and Omar H. Shemdin *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 51-53 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

A program was undertaken to obtain data on wind generated ocean waves in hurricanes by remote sensing techniques. The sensor, a synthetic aperture radar, has collected the first data ever on the directional wave climate throughout a hurricane. This information was found to have inconsistencies with present hurricane wave generation models. F.O.S.

N79-20586*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCES IN LOCAL AREA, MESOSCALE MODELING
Paul R. Swan and Young Lee *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 55-59 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

A two-layer, mesoscale boundary layer model is being developed and validated against San Francisco Bay Area observational data. Author

N79-20587*# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
OBSERVATIONS OF THE MICROCLIMATE OF A LAKE UNDER COLD AIR ADVECTIVE CONDITIONS
R. G. Bill, Jr., R. A. Sutherland, and J. F. Bartholic *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 61-65 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

The moderating effects of Lake Apopka, Florida, on downwind surface temperatures were evaluated under cold air advective conditions. Point temperature measurements north and south of the lake and data obtained from the NOAA satellite and a thermal scanner flown at 1.6 km, indicate that, under conditions of moderate winds (approximately 4m/sec), surface temperatures directly downwind may be higher than surrounding surface temperatures by as much as 5 C. With surface wind speed less than 1m/sec, no substantial temperature effects were observed. Results of this study are being used in land use planning, lake level control and in agriculture for selecting planting sites. Author

N79-20588*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WIND SPEED AND AEROSOL OPTICAL THICKNESS ESTIMATES FROM AIRCRAFT OBSERVATIONS OF SEA FLITTER
R. S. Fraser and Ziauddin Ahmad (Systems and Applied Sciences Corp., Riverdale, Md.) *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 67-70 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Aircraft observed radiances were used to measure surface wind speed and aerosol thickness. Results show that the surface wind speed is related to the width of the glitter pattern. F.O.S.

N79-20589*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE EVALUATION BY NUMERICAL SIMULATION OF THE DESIGN FOR A MICROWAVE PRESSURE SOUNDER (MPS)
Dennis A. Flower and Gordon E. Peckham (Heriot-Watt Univ., Edinburgh, Scotland) *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 71-75 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

The potential accuracy of an active multifrequency millimeter-wave technique for the remote measurement of atmospheric pressure at the Earth's surface was investigated by numerical simulation. Author

N79-20590*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF THE BOUNDARY LAYER
C. Prabhakara *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 77-80 (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Limited information about the boundary layer stratification is obtained from remote infrared spectral measurements in the water vapor window region. A global map of the average strength

of the water vapor spectral lines in the 9 micron window region derived from Nimbus 4 IRIS data is presented to indicate this boundary layer information. Presence of deep convective layer in the intertropical convergence zone and trade wind inversion over the subtropical oceanic high pressure systems are appropriately revealed in this map. Author

N79-20591*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROFILING OF ATMOSPHERIC WATER VAPOR WITH MICROWAVE RADIOMETRY
T. T. Wilheit and G. H. Schaerer *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 81-85 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Weighting functions were developed which express the water vapor information content of microwave radiometric measurements. Retrievals of water vapor profiles are performed using these weighting functions. Author

N79-20592*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADVANCES IN THE REMOTE SENSING OF ATMOSPHERIC TEMPERATURE PROFILES
M. T. Chahine *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 87-91 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Clear-column temperature profiles with a vertical resolution of 2 km in the troposphere and an accuracy of 1.5 K are obtained in the presence of multiple layers of broken clouds using narrow band-pass measurements carefully selected in the 4.18 and 15 micron regions of the CO2 bands. Author

N79-20593*# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
A STATISTICAL METHOD FOR TIME-CONTINUOUS ASSIMILATION OF REMOTE SOUNDING TEMPERATURES
Michael Ghil *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 93-103 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

A time-continuous statistical method is presented for the four-dimensional assimilation of remote sounding temperatures based on radiometric measurements from polar-orbiting satellites. This method is applied to DST-6 data from the NOAA-4 and Nimbus-6 satellites. Experiments are reported in which the state of the atmosphere throughout the test period was determined using a varying amount of satellite data and in which different methods were used for their assimilation. Data from the NOAA-4 satellite only, from Nimbus-6 only, and from both satellites together were used; the methods tested include different variations of the statistical method as well as more traditional methods. The conclusions are that: (1) satellite-derived temperature data can have a modest, but statistically significant positive impact on numerical weather prediction in the two-to-three day range; (2) this impact is highly sensitive to the quantity of data available; and (3) the assimilation method plays a major role in the magnitude of the impact for the same data. F.O.S.

N79-20594*# Wisconsin Univ., Madison.
THE EFFECT OF SEA ICE EXTENT ON THE CLIMATOLOGY OF THE GISS GENERAL CIRCULATION MODEL
G. F. Herman and W. T. Johnson (NASA. Goddard Space Flight Center) *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 105-109 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Two model simulations were calculated with the GISS general circulation model corresponding to hypothetical maximum and minimum January sea ice conditions in the north and south polar regions. Results indicate that there were large differences in the Northern Hemisphere circulation between maximum and minimum ice conditions in zonally averaged temperature, vertically averaged eddy sensible heat flux, and mean 500 mb geopotential height. The calculated differences are found to be greater than the inherent variability of the model. Author

N79-20595*# California Univ., Los Angeles. Dept. of Atmospheric Sciences.
NUMERICAL SIMULATION OF FLOW NEAR STEEP MOUNTAINS WITH A POTENTIAL ENSTROPHY CONSERVING SCHEME FOR THE SHALLOW WATER EQUATIONS
Akio Arakawa *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 111-115 (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Numerical experiments show that use of a potential enstrophy conserving scheme drastically improves numerical simulation of flow near steep mountains. Author

N79-20596*# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
DESIGN AND TESTING OF A NEW PLANETARY BOUNDARY LAYER PARAMETERIZATION
David A. Randall *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 117-120 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

A new planetary boundary layer parameterization was developed. Tests included forecasting experiments. Author

N79-20597*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPERATION AUROROZONE: AN EXPERIMENT IN SUN/WEATHER
R. A. Goldberg and E. Hilsenrath *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 121-125 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Operation Aurorozone was a highly coordinated sequence of 33 rocket flights launched from Poker Flat, Alaska, in September 1976. The effects of aurorally produced X-rays on stratospheric neutral and electrical parameters was studied. The sun/weather coupling between upper and lower regions of the atmosphere is thought to be related to these middle atmospheric parameters. The results show a consistent depletion of ozone above 1 mb during three independent auroral events, with magnitudes in excess of those expected from the measured energy radiation sources. Simultaneously, enhanced conductivity changes were observed to occur in accord with the measured ionizing radiations. F.O.S.

N79-20598*# Wolf Research and Development Corp., Riverdale, Md.
A SIMPLE ALGORITHM FOR INFERRING THE VERTICAL OZONE PROFILE FROM SATELLITE MEASUREMENTS
R. W. L. Thomas and A. C. Holland (NASA. Wallops Flight Center, Wallops Island, Va.) *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 129-133 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

A general methodology for establishing and testing remote sensing inversion procedures has yielded a simple procedure for inverting BUV radiances. Author

N79-20599*# Systems and Applied Sciences Corp., Riverdale, Md.
CLIMATOLOGICAL FEATURES REVEALED BY ESMR DERIVED OCEANIC RAINFALL MAPS
M. S. V. Rao and J. S. Theon (NASA. Goddard Space Flight Center) *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 135-139 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Several new climatological patterns become apparent from the analysis of satellite-derived global oceanic rainfall maps. Five interesting features are briefly discussed. Author

N79-20600*# Colorado State Univ., Fort Collins.
ON THE INTERANNUAL VARIABILITY OF THE OCEAN ATMOSPHERIC SYSTEM
E. R. Reiter *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 141-146 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Several feedback mechanisms between ocean and atmosphere are discussed, which seem to have a decisive influence on the interannual variability of the atmosphere, and on climatic fluctuations of a time scale of 10 to 50 years. Satellite requirements to monitor these feedback processes are outlined briefly. Author

N79-20601*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

NIMBUS 6 ERB SCANNER STUDIES FOR DEVELOPMENT OF EARTH RADIATION BUDGET SATELLITE SYSTEM (ERBSS)

J. T. Suttles, L. M. Avis, and P. G. Renfroe (Vought Corp., Hampton, Va.) *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 147-151 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

The Nimbus 6 ERB scanner data were conducted to support the development of the Earth Radiation Budget Satellite System project. The ERB data were processed in terms of Earth targets and angular bins and used to evaluate currently available directional radiation models for the longwave and shortwave spectral ranges. Results indicate that available longwave models are adequate for the most part while available shortwave models are inadequate. An effort was initiated to develop improved shortwave models for various cloud conditions and various surface types for cloud free conditions. G.Y.

N79-20602*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SAMPLING ANALYSIS FOR THE EARTH RADIATION BUDGET SATELLITE SYSTEM MISSION

E. F. Harrison and G. G. Gibson (Vought Corp., Hampton, Va.) *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 153-157 (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

A study was conducted to identify problems related to sampling the Earth's radiant energy budget and to define a satellite system with sufficient sampling to satisfy science requirements on global, zonal, and regional scales. G.Y.

N79-20603*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STRATOSPHERIC AEROSOLS AND CLIMATIC CHANGE

James B. Pollack and Owen B. Toon *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 159-163 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

The effect of stratospheric aerosols on climate is considered using an aerosol model and a radiative convective 1-D climate model. Author

N79-20604*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

MOUNT AGUNG ERUPTION PROVIDES TEST OF A GLOBAL CLIMATE PERTURBATION

J. E. Hansen, W. C. Wang, and A. A. Lacis *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 165-169 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

The Mt. Agung volcanic eruption in 1963 is used as a test case to examine the climatic response to a global-scale radiative perturbation of the earth's atmosphere. Author

N79-20605*# Wisconsin Univ., Madison.

AN INVESTIGATION OF SURFACE ALBEDO VARIATIONS DURING THE RECENT SAHEL DROUGHT

F. R. Mosher and C. C. Norton *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 171-175 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

Applications Technology Satellite 3 data are used to measure surface albedoes in the African Sahel during the 1967 to 1974 drought. Author

N79-20606*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

GEOPHYSICAL FLUID FLOW MODEL EXPERIMENTS IN SPHERICAL GEOMETRY

W. W. Fowlis and G. H. Fichtl *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 177-181 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

An experimental and theoretical program was undertaken to assist in the design of geophysical fluid flow model experiments for Spacelab. Two new nonintrusive measurement techniques were developed. A theoretical calculation was carried out to guide the design of a proposed atmospheric general circulation model experiment. G.Y.

N79-20607*# Massachusetts Inst. of Tech., Cambridge.

PRELIMINARY TEST OF A COARSE RESOLUTION GCM FOR CLIMATE APPLICATION

J. Hansen (Goddard Inst. of Space Studies), G. Russell (Goddard Inst. of Space Studies), R. Ruedy (Goddard Inst. of Space Studies), K. Kawabata (Goddard Inst. of Space Studies), L. Travis (Goddard Inst. of Space Studies), S. Lebedeff (Goddard Inst. of Space Studies), W. C. Wang (Goddard Inst. of Space Studies), and A. A. Lacis (Goddard Inst. of Space Studies) *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 183-187 (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

Preliminary steps were taken to develop a climate model adequate for seasonal and interannual simulations. Tests of the model against the observed seasonal cycle of key climate properties indicate an encouraging capability for climate applications. G.Y.

N79-20608*# New York Univ., N. Y. Courant Inst. of Math's Sciences.

INTEGRATION SCHEMES FOR CLIMATE PREDICTION

E. Isaacson *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 189-193 refs (For primary document see N79-20575 11-47)

(Grant NsG-5034; Contract EY-76-C-02-3077-000)

Avail: NTIS HC A14/MF A01 CSCL 04B

To assure the conservation of total mass, momentum, energy, vorticity, etc., a method of modifying any given algorithm is presented. The modified scheme has at least the same order of accuracy as the given scheme. Author

N79-20609*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FAST BUT ACCURATE TECHNIQUES FOR CALCULATING RADIATIVE TERMS IN NUMERICAL ATMOSPHERIC MODELS AND IN REMOTE SENSING APPLICATIONS

Albert Arking, Dennis Chesters (Computer Sciences Corp., Silver Spring, Md.), and Ming-Dah Chow (SAI Comsystems Corp., Mclean, Va.) *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 195-200 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

Methods were developed for calculating radiative terms with relatively high accuracy but with sufficient speed, so that they can be used in numerical atmospheric models or in high volume processing of satellite measured radiances for remote sensing of atmospheric and surface parameters. Comparison with commonly used methods in both types of applications indicate improvements in calculating transmittances of factors between two and three, and in calculating radiances and cooling rates of factors between two and seven. G.Y.

N79-20610*# Missouri Univ. -Rolla.

MOLECULAR MODEL OF ICE NUCLEATION

P. L. M. Plummer and B. N. Hale *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 203-206 (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

Two complementary techniques, semi-empirical quantum mechanical calculations and empirical central field pair potential

calculations were used in developing a model of the interaction of water with simple surfaces. G.Y.

N79-20611*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ATMOSPHERIC VARIABILITY EXPERIMENTS (AVE) AND MESOSCALE STRUCTURE

Robert E. Turner and Kelly Hill *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 207-211 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

Information is presented on accuracy and resolution of AVE data sets. Author

N79-20612*# Tennessee Univ. Space Inst., Tullahoma.

MECHANISMS OF THUNDERSTORM RELATED TO MOTION AND SEVERITY

J. R. Connell *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 213-217 (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

A research program was conducted to better understand the relation of vertical shear of the horizontal wind in the environment and of momentum exchange to thunderstorm motion and intensity. G.Y.

N79-20613*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

GENERAL SOLUTIONS FOR THE MOVEMENT OF STORMS

Robert C. Costen *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 219-223 (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

Diagnostic solutions are presented for the displacement velocity of a storm vortex and the velocity of the centroid of the storm's convection. Author

N79-20614*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EQUATIONS FOR THE DYNAMICS OF GUST FRONTS AND SHOCK WAVES

Robert C. Costen *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 225-227 (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

Equations are presented for the growth or decay rates of moving and deforming vortex sheets (gust fronts) and shock waves. The equations exhibit a cross-coupling between these two types of surface discontinuity. Author

N79-20615*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STEREOGRAPHIC CLOUD HEIGHTS FROM SMS/GOES IMAGERY

R. A. Minzner, W. E. Shenk, R. D. Teagle (Defense Mapping Agency Topographic Center, Washington, D.C.), and J. Steranka (GE, Beltsville, Md.) *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 229-233 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

Stereographic pairs of SMS/GOES images, generated simultaneously by the spin-scan cameras of each of two geostationary satellites (SMS 1 and SMS2), separated by 32 degrees of longitude on February 1, 1975, were analyzed photogrametrically to yield cloud heights with a two-sigma uncertainty of 500 meters. These cloud heights compare favorably with heights of the same clouds measured by radar and IR methods. The same SMS image pairs were used to measure mountaintop heights with a mean deviation of 0.24 km from cartographic values. G.Y.

N79-20616*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

WIND ESTIMATES FROM CLOUD MOTIONS: RESULT OF AN IN SITU AIRCRAFT VERIFICATION EXPERIMENT

A. F. Hasler and W. E. Shenk *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 235-239 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

A world wide system of 5 geostationary satellites is being established with a primary objective: the estimation of winds from cloud motions. A series of aircraft experiments were carried out to perform an in situ verification of the satellite cloud winds, under undisturbed to moderately disturbed oceanic weather regimes. G.Y.

N79-20617*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN ERROR ANALYSIS OF TROPICAL CYCLONE DIVERGENCE AND VORTICITY FIELDS DERIVED FROM SATELLITE CLOUD WINDS ON THE ATMOSPHERIC AND OCEANOGRAPHIC INFORMATION PROCESSING SYSTEM (AOIPS)

A. F. Hasler and E. B. Rodgers *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 241-245 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

An advanced Man-Interactive image and data processing system (AOIPS) was developed to extract basic meteorological parameters from satellite data and to perform further analyses. The errors in the satellite derived cloud wind fields for tropical cyclones are investigated. The propagation of these errors through the AOIPS system and their effects on the analysis of horizontal divergence and relative vorticity are evaluated. G.Y.

N79-20618*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MESOSCALE CONVERGENCE PROCEDING THUNDERSTORM DEVELOPMENT DETERMINED FROM CLOUD MOTIONS

Cynthia A. Pelsen *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 247-251 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

Convergence was determined from wind vectors derived from cloudtracking on 5 minute interval SMS-2 data using the AOIPS. G.Y.

N79-20619*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HIGH RESOLUTION TROPICAL CYCLONE WIND FIELDS DETERMINED FROM CLOUD MOTIONS

Edward B. Rodgers, R. Cecil Gentry (GE Space Div. (MATSCO), Beltsville, Md.), William E. Shenk (NOAA/NESS, Camp Springs, Md.), and Vincent Oliver *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 253-257 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

Full resolution rapid scan infrared and visible images from the VISSR sensor on board SMS-2/GEOS-1 satellite have made it possible to maximize the number of tropical cyclone upper and lower tropospheric wind vectors by a factor of 6(2) over that of the images taken at 30 minute (15 minute) intervals. These full resolution rapid scan visible images have also made it possible to derive low level winds near the center of tropical cyclones. Author

N79-20620*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE DATA SYSTEMS TEST-DRESS REHEARSAL FOR FGGE

J. R. Greaves *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 259-263 refs (For primary document see N79-20575 11-47)

Avail: NTIS HC A14/MF A01 CSCL 04B

A series of Data Systems Tests conducted by NASA as a precursor to the First GARP Global Experiment is described. Included is a description of the global data sets acquired and the influence the tests had on the observing system, the data processing plans and research activities of the Global Experiment itself. Author

N79-20621*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMMERCIAL AIRCRAFT DERIVED HIGH RESOLUTION WIND AND TEMPERATURE DATA FROM THE TROPICS FOR FGGE: IMPLICATIONS FOR NASA

R. Steinberg *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 265-270 (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Two programs involving over 100 commercial aircraft were initiated to provide global high resolution in-situ windfield and temperature data during the FGGE. The concepts developed for these programs could have important implications for both meteorology and aviation in the near term. G.Y.

N79-20622*# National Environmental Satellite Service, Madison, Wis.

A SUMMARY OF NIMBUS-6 TEMPERATURE RETRIEVAL ACCURACY STATISTICS FOR DST-5 AND DST-6

C. M. Hayden *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 271-276 (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Statistics compiled from Nimbus-6 temperature retrievals processed during the 18 August-4 September 1975 DST-5, and the 1 February-4 March 1976 DST-6 are addressed. All statistics were compiled from samples of colocated satellite sounding and radiosonde measurements. The colocation window is 222 km in space and 6 hours in time. G.Y.

N79-20623*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

MICROWAVE RADIOMETRIC MEASUREMENTS OF SEA-SURFACE PARAMETERS

B. M. Kendall and H. J. C. Blume *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 277-281 (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

A technique to remotely measure sea-surface temperature and salinity (for concentrations greater than 5 parts-per-thousand) with accuracies of 1 C and 1 part-per-thousand, respectively, was demonstrated with a two-frequency microwave radiometer system. Author

N79-20624*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CLOUD CENSUS AND RAINFALL ESTIMATION FROM SATELLITE IMAGES

F. R. Mosher, D. P. Wylie, and J. H. Chu *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 283-287 refs (For primary document see N79-20575 11-47)
(Contract NAS5-23462)
Avail: NTIS HC A14/MF A01 CSCL 04B

A program was undertaken to develop techniques for measurement of cloud and rainfall parameters from satellite images. Author

N79-20625*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMPARISON OF THE LAST TWO WINTER SEASON MONTHLY ZONAL CLOUD FRACTIONS AS DERIVED FROM NIMBUS-6 ERB DATA

Robert J. Curran *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 289-293 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Monthly zonal albedo determinations made by Nimbus-6 ERB were used to form monthly zonal cloud fractions. The Fall-Winter-Spring seasons of 1975-76 are compared with the same seasons 1976-77. Author

N79-20626*# Drexel Univ., Philadelphia, Pa.

ELECTROCHEMICAL CONCENTRATION CELL OZONESONDE PERFORMANCE EVALUATION

A. L. Torres and A. R. Bandy *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 295-297 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

A large number of electrochemical concentration cell (EDD) ozonesondes were calibrated relative to ultraviolet photometric absorption (254 nm) to determine their precision and accuracy. The average agreement with UV photometry was found to be good, but with considerable variation from one ECC ozonesonde to another. Applying individual calibrations to vertical ozone profiles reduced the systematic differences between ECC ozonesonde total ozone values and Dobson spectrophotometric determinations of the same quantity, but did not improve random differences. F.O.S.

N79-20627*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DECONVOLUTION OF EARTH RADIATION BUDGET DATA

R. N. Green and G. L. Smith *In its* 3d NASA Weather and Climate Program Sci. Rev. 1977 p 299-303 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

The theory of deconvolution of wide field of view Earth radiation measurements is applied to Nimbus 6 ERB data. Results with a 15 deg resolution are presented. Author

N79-20628*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SIMULATION STUDY OF A METHOD FOR ANALYZING WIDE FIELD OF VIEW RADIOMETER MEASUREMENTS FROM SATELLITES AND SOME ANALYSIS OF ESSA 7 DATA

W. L. Weaver *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 305-309 (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Method of relating wide field of view radiometer measurements from satellites to the Earth longwave flux field is simulated and is used to obtain zonal and global averages of longwave (LW) flux for ESSA 7. Author

N79-20629*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ERBSS SCANNER PERFORMANCE IN THE PRESENCE OF RADIATION DIRECTIONAL MODEL ERRORS

L. M. Avis (Vought Corp., Hampton, Va.) and P. G. Renfroe *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 311-315 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Simulation studies of the ERBSS scanner were performed to determine the sensitivity of the inferred flux at the top of the atmosphere to radiation directional model errors for candidate scan plane orientations. Author

N79-20630*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CLOUD COVER MODELING

O. E. Smith *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 317-321 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

Results from two investigations in modeling cloud cover are presented. These are a univariate model and a multivariate model for cloud cover. F.O.S.

N79-20631*# City Univ. of New York.

A SUMMARY OF MONTHLY MEAN SIMULATION EXPERIMENTS WITH THE GISS MODEL

Jerome Spar *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 323-327 refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

The statistical results of 8 monthly mean simulation experiments with the GISS general circulation model are summarized for the Northern Hemisphere in terms of the fields of sea-level pressure, 500-mb. height, and 850-mb. temperature. Author

N79-20632*# State Univ. of New York at Purchase.

SPECTRAL ENERGETICS AND PREDICTABILITY STUDIES

J. Tenenbaum *In* NASA. Goddard Space Flight Center 3d NASA Weather and Climate Program Sci. Rev. 1977 p 329-333

refs (For primary document see N79-20575 11-47)
Avail: NTIS HC A14/MF A01 CSCL 04B

One and two-dimensional spectral analyses were performed on the GISS general circulation model. The one-dimensional results imply that low eddy kinetic energy is caused by low conversions from the zonal mean kinetic energy. The two-dimensional results confirm that low wave number spectral coefficients approach the predictability limit slower than high wave number coefficients and suggest ways of estimating the rate of approach to the predictability limit. Author

N79-20633*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FOURTH NATIONAL AERONAUTICS AND SPACE ADMINISTRATION WEATHER AND CLIMATE PROGRAM SCIENCE REVIEW
Earl R. Kreins, ed. 1979 396 p refs Proc. held at Greenbelt, Md., 24-25 Jan. 1979
(NASA-CP-2076) Avail: NTIS HC A17/MF A01 CSCL 04B

The NASA Weather and Climate Program has two major thrusts. The first involves the development of experimental and prototype operational satellite systems, sensors, and space facilities for monitoring and understanding the atmosphere. The second thrust involves basic scientific investigation aimed at studying the physical and chemical processes which control weather and climate. This fourth science review concentrated on the scientific research rather than the hardware development aspect of the program. These proceedings contain 65 papers covering the three general areas: severe storms and local weather research, global weather, and climate. For individual titles, see N79-20634 through N79-20698.

N79-20634*# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
THUNDERSTORM/ENVIRONMENT INTERACTIONS THAT AFFECT SUBSEQUENT CONVECTION
R. A. Maddox and L. R. Hoxit *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 1-6 refs (For primary document see N79-20633 11-47)
(NASA Order RC-7705)
(Paper-1) Avail: NTIS HC A17/MF A01 CSCL 04B

Mesoscale kinematics and thermodynamics of severe thunderstorm-baroclinic zone interactions, and the development and evolution of mesoscale pressure systems associated with strong convective storms, are being studied in an ongoing research project. Author

N79-20635*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THUNDERSTORM VERTICAL VELOCITIES AND MASS FLUX ESTIMATED FROM SATELLITE DATA
Robert F. Adler and Douglas D. Fenn (Gen. Elec. Co., Beltsville, Md.) *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 7-13 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Infrared geosynchronous satellite data with an interval of five minutes between images are used to estimate thunderstorm top ascent rates on two case study days. A mean vertical velocity of 3.5/ms for 19 clouds is calculated at a height of 8.7 km. This upward motion is representative of an area of approximately 10km on a side. Thunderstorm mass flux of approximately 2x10 to the 11th power/gs is calculated, which compares favorably with previous estimates. There is a significant difference in the mean calculated vertical velocity between elements associated with severe weather reports (w bar=4.6/ms) and those with no such reports (2.5/ms). Calculations were made using a velocity profile for an axially symmetric jet to estimate the peak updraft velocity. For the largest observed w value of 7.8/ms the calculation indicates a peak updraft of approximately 50/ms. Author

N79-20636*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THUNDERSTORM FORMATION AND INTENSITY DETERMINED FROM A THREE-DIMENSIONAL SUBSYNOPTIC-SCALE TRAJECTORY MODEL
G. S. Wilson *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 15-20 refs (For primary document see N79-20633 11-47)
(Contract NAS8-31773)
Avail: NTIS HC A17/MF A01 CSCL 04B

A diagnostic trajectory model was used to provide a better understanding of the interrelationships between synoptic and convective-scale systems. Results indicate that synoptic scale systems exert a strong controlling influence over the formation and intensity of small mesoscale convective circulations. G.Y.

N79-20637*# Saint Louis Univ., Mo.
KINETIC ENERGY BUDGET STUDIES OF AREAS OF CONVECTION
Henry E. Fuelberg *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 21-25 refs (For primary document see N79-20633 11-47)
(Contract NAS8-32838)
Avail: NTIS HC A17/MF A01 CSCL 04B

Synoptic-scale kinetic energy budgets are being computed for three cases when large areas of intense convection occurred over the Central United States. Major energy activity occurs in the storm areas. Author

N79-20638*# Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
THE DISTRIBUTION OF BAROCLINITY WITHIN THE ATMOSPHERE
D. A. Barber and M. Wai *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 27-32 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

A three dimensional numerical interpolation scheme which resolves frontal gradients with high fidelity was developed and is being applied to the study of atmospheric upper baroclinic zones. G.Y.

N79-20639*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON BETWEEN GOES-1 IR DIGITAL DATA AND RADAR DATA FOR THE 4 APRIL 1977 SEVERE STORMS OUTBREAK
C. A. Peslen and Richard Anthony (Gen. Elec. Co., Beltsville, Md.) *In its* 4th NASA Weather and Climate Program Sci. Rev 1979 p 33-38 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The 4 April 1977 severe storms outbreak over Georgia and Alabama provided an excellent opportunity to examine the complementary characteristics between satellite and radar data. Author

N79-20640*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FORMULAS FOR DETERMINING STORM MOVEMENT FROM THE SURROUNDING FIELDS
R. C. Costen *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 37-40 ref (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Formulas are given for determining a conserved property of a storm and its centroid from an scalar field that has a tendency equation. The velocity of the centroid is also given. These formulas depend only on fields that are external to the storm. Author

N79-20641*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A MESOSCALE NUMERICAL MODEL AND THE DEVELOPMENT OF A SEVERE STORM PREDICTION SYSTEM
M. L. Kaplan *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci., Rev. 1979 p 41-48 (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The use of a mesoscale numerical model for predicting preferred zones of severe storm development is analyzed. A 60 consecutive day real-time test of the prediction system during the spring of 1978 proved useful in determining the problems and potentialities of such a system. A case study of severe

storm development from this test period is described and compared to the model forecast fields. G.Y.

N79-20642*# Drexel Univ., Philadelphia, Pa.
NUMERICAL PREDICTION EXPERIMENTS SIMULATING THE IMPACT OF MESOSCALE SATELLITE DATA Semiannual Progress Report
Carl W. Kreitzberg *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 49-53 refs (For primary document see N79-20633 11-47)
(Grant NsG-5162)
Avail: NTIS HC A17/MF A01 CSCL 04B

Recent developments in mesometeorology are summarized to place this research in perspective. Recent advances in computer analysis and forecast system development that provide the basis for the simulation tests are discussed. The impact of NIMBUS-6 humidity data on analyses off the West Coast are shown and incorporation of geopotential gradient data is discussed. Experiments to demonstrate the feasibility of incorporating satellite-derived wind fields in mesoscale severe storm models are mentioned briefly. Author

N79-20643*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NASA ACTIVITIES AND INTERESTS IN THE 1979 REGIONAL AND STORM SCALE EXPERIMENT
Robert E. Turner and Kelly Hill *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 55-60 (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

A brief overview is presented of NASA's planned involvement in an interagency severe storms field measurement program. Author

N79-20644*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STEREOGRAPHIC CLOUD HEIGHTS FROM THE IMAGERY OF TWO SCAN-SYNCHRONIZED GEOSTATIONARY SATELLITES
R. A. Minzner, R. D. Teagle (Defense Mapping Agency Topographic Center), J. Steranka (Gen. Elec. Co., Beltsville, Md.), and W. E. Shenk *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 61-66 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Scan synchronization of the sensors of two SMS-GOES satellites yields imagery from which cloud heights can be derived stereographically with a theoretical two-sigma random uncertainty of + or - 0.25 km for pairs of satellites separated by 60 degrees of longitude. Systematic height errors due to cloud motion can be kept below 100 m for all clouds with east-west components of speed below hurricane speed, provided the scan synchronization is within 40 seconds at the mid-point latitude, and the spin axis of each satellite is parallel to that of the earth. Author

N79-20645*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FOUR DIMENSIONAL OBSERVATIONS OF CLOUDS FROM GEOSYNCHRONOUS ORBIT USING STEREO DISPLAY AND MEASUREMENT TECHNIQUES ON AN INTERACTIVE INFORMATION PROCESSING SYSTEM
A. F. Hasler, M. desJardins, and W. E. Shenk *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 67-72 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Simultaneous Geosynchronous Operational Environmental Satellite (GOES) 1 km resolution visible image pairs can provide quantitative three dimensional measurements of clouds. These data have great potential for severe storms research and as a basic parameter measurement source for other areas of meteorology (e.g. climate). These stereo cloud height measurements are not subject to the errors and ambiguities caused by unknown cloud emissivity and temperature profiles that are associated with infrared techniques. This effort describes the display and measurement of stereo data using digital processing techniques. Author

N79-20646*# Harvard Univ., Cambridge, Mass.
ANALYTIC STUDIES ON SATELLITE DETECTION OF SEVERE, TWO-CELL TORNADOES
George F. Carrier, Paul Dergarabedian, and Francis E. Fendell *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 73-77 refs Prepared in cooperation with TRW, Inc., Redondo Beach, Calif. (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

It is argued that a two-cell structure is likely to be the unique property, and potentially satellite-accessible observable, of the exceptionally severe tornado. Analysis elucidating the dynamic, thermodynamic, and geometric properties of this two-cell structure is described. The analysis ultimately will furnish instrumentation requirements. Author

N79-20647*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MEASUREMENT OF HURRICANE WINDS AND WAVES WITH A SYNTHETIC APERTURE RADAR
O. H. Shemdin and D. B. King *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 79-83 refs Sponsored by NASA (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

An analysis of data collected in a hurricane research program is presented. The data were collected with a Synthetic Aperture Radar (SAR) during five aircraft flights in the Atlantic in August and September, 1976. Work was conducted in two areas. The first is an analysis of the L-band SAR data in a scatterometer mode to determine the surface windspeeds in hurricanes, in a similar manner to that done by an X-band scatterometer. The second area was to use the SAR to examine the wave patterns in hurricanes. The wave patterns in all of the storms are similar and show a marked radial asymmetry. G.Y.

N79-20648*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
ESTIMATING TROPICAL CYCLONE OUTER SURFACE WINDS FROM SATELLITE MICROWAVE DATA
Stanley Q. Kidder *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 85-89 refs (For primary document see N79-20633 11-47)
(Grant NsG-5258)
Avail: NTIS HC A17/MF A01 CSCL 04B

Warm temperature anomalies over tropical cyclones are sensed by the 55.45 GHz channel of the Nimbus 6 Scanning Microwave Spectrometer. Radial brightness temperature gradients are related to radial surface pressure gradients through the hydrostatic and radiative transfer equations. Surface wind speeds outside of the radius of maximum wind are calculated from the pressure gradients and compared with observations. Author

N79-20649*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RAIN OBSERVATIONS IN TROPICAL STORM CORA
T. T. Wilheit, A. T. C. Chang, J. L. King, E. B. Rodgers, R. A. Nieman (Computer Sci. Corp., Silver Spring, Md.), B. M. Krupp (Computer Sci. Corp., Silver Spring, Md.), H. Siddalingaiah (Computer Sci. Corp., Silver Spring, Md.), B. C. Diesen (Dept. of the Air Force), and J. Stratigos (Georgia Inst. of Tech.) *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 91-95 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Passive microwave observations were made in tropical storm Cora at 19.35 and 94GHz. These observations suggest that 94GHz is appropriate for mapping the extent of rain over either land or ocean backgrounds and that some rainfall intensity measurement is also possible. Author

N79-20650*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN OBJECTIVE METHOD FOR FORECASTING TROPICAL CYCLONE INTENSITY AND MOTION USING NIMBUS-5 ESMR MEASUREMENTS AND NON-SATELLITE DERIVED DESCRIPTORS
H. E. Hunter (ADAPT Serv. Corp.), E. B. Rodgers, and W. E. Shenk *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 97-101 refs (For primary document see N79-20633

11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

An empirical analysis program, based on finding an optimal representation of the data was applied to 120 observations of 29 1973 and 1974 North Pacific tropical cyclones. Each observation consists of a field of Nimbus-5 Electrically Scanning Microwave Radiometer radiation measurements at 267 grid points covering and surrounding the tropical cyclone plus nine other non-satellite derived discriptors. Forecast algorithms to estimate storm intensity and motion at 12, 24, 48, and 72 hours after each observation were developed using an independent eigen screening analysis. These algorithms were based on best track data. Independent testing of these algorithms showed that the performance of most of these algorithms were better than persistence and the algorithms forecasting 24, 48, and 72 hour maximum wind speed were better than those made operationally by the Joint Typhoon Warning Center for 1973 and 1974 that did not use best track data. G.Y.

N79-20651*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STATISTICAL TECHNIQUE FOR DETERMINING RAINFALL OVER LAND EMPLOYING NIMBUS-6 ESMR MEASUREMENTS
E. B. Rodgers, H. Siddalingaiah (Computer Sci. Corp., Silver Spring, Md.), A. T. C. Chang, and T. T. Wilheit *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 103-108 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

An empirical method was employed to delineate synoptic scale rainfall over land utilizing Nimbus-6 ESMR measurements. G.Y.

N79-20652*# Laguna Research Lab., Laguna Beach, Calif.
MIE DISDROMETER FOR IN SITU MEASUREMENT OF DROP SIZE DISTRIBUTIONS
H. G. Loos *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 109-113 (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Test results are shown for a disdrometer breadboard which uses Mie scattering and incoherent optical correlation for in situ measurement of drop size distribution in a cloud chamber. Author

N79-20653*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ADVANTAGES OF ICE CRYSTAL GROWTH EXPERIMENTS IN A LOW GRAVITY ENVIRONMENT c48
B. J. Anderson, V. W. Keller, and J. Hallett (Desert Res. Inst.) *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 115-120 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The effects of convective fluid motions and mechanical supports on ice crystal growth in experiments conducted on earth can be inferred from studies conducted in their absence in a low-gravity environment. Current experimental results indicate the effects may be significant. Author

N79-20654*# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
FUTURE FREEZE FORECASTING
J. F. Bartholic and R. A. Sutherland *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 121-126 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Real time GOES thermal data acquisition, an energy balance minimum temperature prediction model and a statistical model are incorporated into a minicomputer system. These components make up the operational 'Satellite Freeze Forecast System' being used to aid NOAA, NWS forecasters in developing their freeze forecasts. The general concept of the system is presented in this paper. Specific detailed aspects of the system can be found in the reference cited. Author

N79-20655*# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
REMOTE SENSING APPLIED TO THE EVALUATION OF CROP FREEZE PROTECTION DEVICES
R. A. Sutherland *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 127-131 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Thermal images from an aircraft-mounted scanner are used to evaluate the effectiveness of crop freeze protection devices. Fuel oil heaters, wind machines and irrigation systems are evaluated from flights at an altitude of 450 m over an experimental citrus grove of 1.5 hectares. Author

N79-20656*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SENSITIVITY OF FORECAST SKILL TO DIFFERENT OBJECTIVE ANALYSIS SCHEMES
W. E. Baker *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 133-137 refs Sponsored in part by NAS-NRC (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Numerical weather forecasts are characterized by rapidly declining skill in the first 48 to 72 h. Recent estimates of the sources of forecast error indicate that the inaccurate specification of the initial conditions contributes substantially to this error. The sensitivity of the forecast skill to the initial conditions is examined by comparing a set of real-data experiments whose initial data were obtained with two different analysis schemes. Results are presented to emphasize the importance of the objective analysis techniques used in the assimilation of observational data. Author

N79-20657*# Maryland Univ., College Park.
NONLINEAR INITIALIZATION OF THE GLAS MODEL
F. Baer *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 139-145 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

A simplified version of the GLAS model is linearized and the normal modes extracted. These modes show the necessary separation for nonlinear initialization. Author

N79-20658*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CASE STUDIES OF MAJOR DST-6 SOUNDING IMPACTS WITH THE GLAS MODEL
R. Atlas *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 147-151 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Two case studies of DST-6 sounding impacts are presented. In each of these cases, major improvements to the GLAS model's forecasts of specific synoptic features resulted from including satellite-sounding data in the initial analysis. Author

N79-20659*# California Univ., Los Angeles. Dept. of Atmospheric Sciences.
SOME ASPECTS OF THE NEW UCLA GENERAL CIRCULATION MODEL
M. J. Suarez *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 153-157 (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

A potential enstrophy conserving scheme and a modified beta-coordinate have been coded in the UCLA general circulation model. The new model is being tested with global simulation experiments. Author

N79-20660*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF CLOUDS ON THE EARTH'S RADIATION BALANCE
G. F. Herman (Wisconsin Univ. - Madison), M. L. C. Wu (NAS-NRC), and W. T. Johnson (Sigma Data Serv. Corp.) *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 159-162 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The effect of global cloudiness on the radiation balance at the top of the atmosphere is studied in general circulation model experiments. Wintertime simulations were conducted with clouds that had realistic optical properties, and were compared with simulations in which the clouds were transparent to either solar or thermal radiation. Clouds increase the net balance by limiting longwave loss to space, but decrease it by reflecting solar radiation. It is found that the net result of cloudiness is to maintain net radiation which is less than would be realized under clear conditions: Clouds cause the net radiation at the top of the atmosphere to increase due to longwave absorption, but to decrease even more due to cloud reflectance of solar radiation.
Author

N79-20661*# Maryland Univ., College Park.
A TEST OF A CUMULUS PARAMETERIZATION MODEL USING THE GATE DATA
D. Rodenhuis *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 163-170 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Two parametric, ensemble cloud models were tested with data obtained during GATE (GARP Atlantic Tropical Experiment) (1974). The first model is an adaption of the Arakawa-Schubert scheme which uses an entraining jet to represent individual cumulus cloud types. The second model consists of an ensemble of cylindrical cells to represent the convective cloud field. G.Y.

N79-20662*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECT OF A PACIFIC SEA SURFACE TEMPERATURE ANOMALY ON THE CIRCULATION OVER NORTH AMERICA
J. Shukla (MIT, Cambridge) and B. Bangaru (Sigma Data Serv. Corp.) *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 171-176 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

During the fall and winter of 1976-1977, sea surface temperature (SST) in the north Pacific was characterized by abnormally cold temperatures in the central and western portions of the north Pacific with a warm pool located off the west coast of the U.S. It was suggested that the north Pacific SST anomalies were one of the multiple causes of the abnormally cold temperatures in eastern North America during the 1976-1977 winter. An attempt was made to test this hypothesis by conducting a numerical experiment with the GLAS general circulation model. G.Y.

N79-20663*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SENSIBLE AND LATENT HEATING OF THE ATMOSPHERE AS INFERRED FROM DST-6 DATA
G. F. Herman (Wisconsin Univ. - Madison), S. D. Schubert (Wisconsin Univ. - Madison), and W. T. Johnson (Sigma Data Ser. Corp.) *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 177-181 refs (For primary document see N79-20633 11-47)
(Grant NsG-5223)
Avail: NTIS HC A17/MF A01 CSCL 04B

The average distribution of convective latent heating, boundary layer sensible heat flux, and vertical velocity are determined for the winter 1976 DST period from GLAS model diagnostics. Key features are the regions of intense latent heating over Brazil, Central Africa, and Indonesia; and the regions of strong sensible heating due to air mass modification over the North Atlantic and North Pacific Oceans. Author

N79-20664*# New York Univ., N. Y. Inst. of Mathematical Sciences.
NUMERICAL METHODS FOR METEOROLOGY AND CLIMATOLOGY
E. Isaacson, D. Marchesin, and G. Zwas *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 183-190 refs (For primary document see N79-20633 11-47)
(Grant NsG-5034; Contract EY-76-C-02-3077)
Avail: NTIS HC A17/MF A01 CSCL 04B

Efficient numerical methods for long term weather forecasting are developed. One implicit and one explicit scheme are compared as to accuracy. Author

N79-20665*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ADVANCED METEOROLOGICAL TEMPERATURE SOUNDER (AMTS) SIMULATIONS
J. Susskin, A. Rosenberg (Sigma Data Serv. Corp.), and L. D. Kaplan *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 191-196 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Simulation studies are reported on temperature retrievals from AMTS and their effect on atmospheric analysis. Observations are simulated from radiosonde reports and observed cloud cover. Temperature retrievals are performed and RMS temperature and thickness errors are calculated relative to the radiosonde profiles and compared to similarly generated HIRS statistics. Significant improvement over HIRS is found throughout the atmosphere but especially in the stratosphere and lower troposphere. G.Y.

N79-20666*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REMOTE SENSING OF CLOUD DISTRIBUTION
M. T. Chahine *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 197-204 refs Sponsored by NASA (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Day and night mapping of the global distribution of the horizontal cloud-cover and the corresponding cloud-top pressure levels can be derived from the same infrared data used to derive clear column temperature profiles. Applications to the 15 micrometer VTPR data are given. Extension of this approach for the determination of the radiative transfer properties of clouds is presented and the possibility of using such information to infer cloud types is discussed. Author

N79-20667*# Wisconsin Univ. - Madison.
VISIBLE FLUX VARIATIONS ACROSS FINITE CLOUDS
Frederick R. Mosher *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 205-208 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

A radiative transfer model developed to computer visible flux variations across and within finite clouds of varying shapes is described. The technique has much of the versatility of Monte Carlo models, as well as the speed of the analytical finite cloud models. J.M.S.

N79-20668*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STUDIES OF SNOWPACK PROPERTIES BY PASSIVE MICROWAVE RADIOMETRY
A. T. C. Chang, D. K. Hall, J. L. Foster, A. Rango, and T. J. Schmugge *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 209-215 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Research involving the microwave characteristics of snow was undertaken in order to expand the information content currently available from remote sensing, namely the measurement of snowcovered area. Microwave radiation emitted from beneath the snow surface can be sensed and thus permits information on internal snowpack properties to be inferred. The intensity of radiation received is a function of the average temperature and emissivity of the snow layers and is commonly referred to as the brightness temperature (T sub B). The T sub B varies with snow grain and crystal sizes, liquid water content, and snowpack temperature. The T sub B of the 0.8 cm wavelength channel was found to decrease more so with increasing snow depth than the 1.4 cm channel. More scattering of the shorter wavelength radiation occurs thus resulting in a lower T sub B for shorter wavelengths in a dry snowpack. The longer 21.0 cm wavelength was used to assess the condition of the underlying ground.
Author

N79-20669*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODELLED AND MEASURED ENERGY EXCHANGE AT A SNOW SURFACE
Isidore Halberstam *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 217-222 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Results of a model developed at JPL for the energy interchange between the atmosphere and the snow are compared with measurements made over a snowfield during a warm period of March, 1978. Both model and measurements show that turbulent fluxes are considerably smaller than the radiative fluxes, especially during the day. The computation of turbulent fluxes for both model and data is apparently lacking because of problems inherent in the stable atmosphere. Author

N79-20670*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE MICROWAVE RADIOMETER SIGNATURE OF ARTIFICALLY GENERATED SEA FOAM
B. M. Kendall and C. T. Swift *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 223-225 (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Microwave radiometer experiments were undertaken to measure the thermal emission from artificially generated sea foam. This data is used to quantify the physics of emission from the ocean to more accurately retrieve geophysical parameters of interest. J.M.S.

N79-20671*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MODEL FOR THE MICROWAVE EMISSIVITY OF THE OCEAN'S SURFACE AS A FUNCTION OF WIND SPEED
Thomas T. Wilheit *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 227-232 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

A quantitative model is presented which describes the ocean surface as an ensemble of flat facets with slopes distributed partially covered with an absorbing nonpolarized foam layer. Experimental evidence is presented for this model. J.M.S.

N79-20672*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATION OF NIMBUS-6 MICROWAVE DATA TO PROBLEMS IN PRECIPITATION PREDICTION FOR THE PACIFIC WEST COAST
W. Viezee (SRI Intern., Menlo Park, Calif.), H. Shigeishi (SRI Intern., Menlo Park, Calif.), and A. T. C. Chang *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 233-240 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The preliminary results of a research study that emphasizes the analysis and interpretation of data related to total precipitable water and nonprecipitating cloud liquid water obtained from NIMBUS-6 SCAMS are reported. Sixteen cyclonic storm situations in the northeastern Pacific Ocean that resulted in significant rainfall along the west coast of the United States during the winter season October 1975 through February 1976 are analyzed in terms of their distributions and amounts of total water vapor and liquid water, as obtained from SCAMS data. The water-substance analyses for each storm case are related to the distribution and amount of coastal precipitation observed during the subsequent time period when the storm system crosses the coastline. Concomitant precipitation predictions from the LFM are also incorporated. Techniques by which satellite microwave data over the ocean can be used to improve precipitation prediction for the Pacific West Coast are emphasized. J.M.S.

N79-20673*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A STUDY OF THE EXPECTED EFFECTS OF LATITUDE-DEPENDENT ROTATION RATE ON LABORATORY GEOPHYSICAL FLOW EXPERIMENTS
J. E. Geisler (Miami Univ.) and W. W. Fowlis *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 241-245 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Results of a theoretical model study of some of the expected effects of spherical geometry on laboratory simulations of the type of geophysical flow that dominates the general circulation of the earth's troposphere are reported. J.M.S.

N79-20674*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF SURFACE REFLECTION AND CLOUDS ON THE ESTIMATION OF TOTAL OZONE FROM SATELLITE MEASUREMENTS
R. S. Fraser and Z. Ahmad (Systems and Appl. Sci. Corp., Riverdale, Md.) *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 247-252 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The total amount of ozone in a vertical column is being measured by Nimbus 4 and 7 observations of the intensity of ultraviolet sunlight scattered from the earth. The algorithm for deriving the amount of ozone from the observations uses the assumption that the surface reflects the light isotropically and the albedo is independent of wavelength. The effects of anisotropic surfaces and clouds on the estimate of total ozone are computed for models of the earth-atmosphere system. Author

N79-20675*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATION OF A COUPLED AEROSOL FORMATION: RADIATIVE TRANSFER MODEL TO CLIMATIC STUDIES OF AEROSOLS
O. B. Toon and J. B. Pollack *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 253-257 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

A sophisticated one dimensional physical-chemical model of the formation and evolution of stratospheric aerosols was used to predict the size and number concentration of the stratospheric aerosols as functions of time and altitude following: a large volcanic eruption; increased addition of carbonyl sulfide (OCS) or sulfur dioxide (SO2) to the troposphere; increased supersonic aircraft (SST) flights in the stratosphere; and, large numbers of space shuttle (SS) flights through the stratosphere. A radiative-convective one dimensional climate sensitivity study, using the results of the aerosol formation model, was performed to assess the ground level climatic significance of these perturbations to the stratospheric aerosol layer. Volcanic eruptions and large OCS or SO2 increases could cause significant climatic changes. Currently projected SS launches and moderate fleets of SST's are unlikely to upset the stratospheric aerosol layer enough to significantly impact climate. J.M.S.

N79-20676*# Maryland Univ., College Park.
PERTURBATION OF THE ZONAL RADIATION BALANCE BY A STRATOSPHERE AEROSOL LAYER
Harshvardhan *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 259-263 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The effect of stratospheric aerosols on the earth's monthly zonal radiation balance is investigated using a model layer consisting of 75% H2SO4, which is the primary constituent of the background aerosol layer. Author

N79-20677*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
SCATTERING BY RANDOMLY ORIENTED ELLIPSOIDS: APPLICATION TO AEROSOL AND CLOUD PROBLEMS
Shoji Asano, Makoto Sato, and James E. Hansen *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 265-269 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

A program was developed for computing the scattering and absorption by arbitrarily oriented and randomly oriented prolate and oblate spheroids. This permits examination of the effect of particle shape for cases ranging from needles through spheres

to platelets. Applications of this capability to aerosol and cloud problems are discussed. Initial results suggest that the effect of nonspherical particle shape on transfer of radiation through aerosol layers and cirrus clouds, as required for many climate studies, can be readily accounted for by defining an appropriate effective spherical particle radius. J.M.S.

N79-20678*# EG and G Washington Analytical Services Center, Riverdale, Md.

ERROR IN TOTAL OZONE MEASUREMENTS ARISING FROM AEROSOL ATTENUATION

Robert W. L. Thomas (Clarendon Lab., Oxford) and Reid E. Basher *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 271-276 refs (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

A generalized least squares method for deducing both total ozone and aerosol extinction spectrum parameters from Dobson spectrophotometer measurements was developed. An error analysis applied to this system indicates that there is little advantage to additional measurements once a sufficient number of line pairs have been employed to solve for the selected detail in the attenuation model. It is shown that when there is a predominance of small particles (less than about 0.35 microns in diameter) the total ozone from the standard AD system is too high by about one percent. When larger particles are present the derived total ozone may be an overestimate or an underestimate but serious errors occur only for narrow polydispersions. J.M.S.

N79-20679*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE SEASONAL AND INTERANNUAL VARIABILITY OF TOTAL OZONE AS REVEALED BY THE BUV NIMBUS-4 EXPERIMENT

Ernest Hilsenrath and Barry Schlesinger (Systems and Applied Sciences, Riverdale, Md.) *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 277-286 refs (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

The BUV/Nimbus-4 total ozone data is analyzed with emphasis on the seasonal and interannual variability for the period April 1970 to April 1972. An objective analysis using a Fourier expansion shows the annual wave dominates at mid and high latitudes where the semiannual wave becomes significant in the tropics. A small interannual difference is detected and is most likely due to changes in the general circulation. J.M.S.

N79-20680*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.

HOHENPEISSENBERG OZONESONE INTERCOMPARISON

A. C. Holland and A. L. Torres *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 287-289 ref (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

A series of dual-instrument vertical ozone soundings was carried out for the purpose of comparing the Electrochemical Concentration Cell Ozonesonde with different ozonesondes used by the international scientific community. Total ozone overburdens at the time of the soundings were also measured with a Dobson spectrophotometer. Author

N79-20681*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE REFLECTANCE CHARACTERISTICS OF SNOW COVERED SURFACES

E. S. Batten *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 291-295 ref (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

Data analysis techniques were developed to most efficiently use available satellite measurements to determine and understand components of the surface energy budget for ice and snow-covered areas. The emphasis is placed on identifying the important components of the heat budget related to snow surfaces, specifically the albedo and the energy consumed in the melting process. Ice and snow charts are prepared by NOAA from satellite observations which map areas into three relative reflectivity zones. Field measurements are analyzed of the reflectivity of an open snow field to assist in the interpretation of the NOAA reflectivity zones. J.M.S.

N79-20682*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE ANNUAL CYCLE OF EARTH EMITTED RADIATION DISTRIBUTION

T. D. Bess and G. L. Smith *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 297-301 refs (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

Measurements of longwave radiation from the Earth Radiation Budget (ERB) experiment aboard the Nimbus 6 spacecraft have been analyzed to show the annual cycle of the distribution of Earth emitted radiation. Author

N79-20683*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SPATIAL DISTRIBUTION OF EARTH FLUX DENSITY FROM UNRESTRICTED FIELD OF VIEW RADIATION MEASUREMENTS

W. L. Weaver *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 303-307 refs (For primary document see N79-20633 11-47)

(Paper-50) Avail: NTIS HC A17/MF A01 CSCL 04B

Results of an analysis to determine if unrestricted field of view measurements can be used to estimate flux densities on scales smaller than the detector's Earth field of view are reported. Simple geometric considerations were employed to reduce simulated irradiances to Earth flux densities. A spatial distribution of emitted flux density is also presented and discussed which was inferred from unrestricted field of view measurements of Nimbus 6. J.M.S.

N79-20684*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

CORRELATED k-DISTRIBUTION METHOD FOR RADIATIVE TRANSFER IN CLIMATE MODELS: APPLICATION TO EFFECT OF CIRRUS CLOUDS ON CLIMATE

Andrew A. Lacis, Wei-Chyung Wang, and James E. Hansen *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 309-314 refs (For primary document see N79-20633 11-47)

(Paper-51) Avail: NTIS HC A17/MF A01 CSCL 04B

A radiative transfer method appropriate for use in simple climate models and three dimensional global climate models was developed. It is fully interactive with climate changes, such as in the temperature-pressure profile, cloud distribution, and atmospheric composition, and it is accurate throughout the troposphere and stratosphere. The vertical inhomogeneity of the atmosphere is accounted for by assuming a correlation of gaseous k-distributions of different pressures and temperatures. Line-by-line calculations are made to demonstrate that The method is remarkably accurate. The method is then used in a one-dimensional radiative-convective climate model to study the effect of cirrus clouds on surface temperature. It is shown that an increase in cirrus cloud cover can cause a significant warming of the troposphere and the Earth's surface, by the mechanism of an enhanced green-house effect. The dependence of this phenomenon on cloud optical thickness, altitude, and latitude is investigated. J.M.S.

N79-20685*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

WORLDWIDE CLOUD COVER MODEL

O. E. Smith and Paul N. Sommerville (Fla. Technol. Univ., Orlando) *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 315-318 refs (For primary document see N79-20633 11-47)

(Paper-52) Avail: NTIS HC A17/MF A01 CSCL 04B

Classifying worldwide cloudiness into homogeneous regions, using a satellite data set containing day IR, night IR, incoming, and absorbed solar radiation measurements on a 2.5-degree latitude-longitude grid is considered. Methods of analysis are presented. J.M.S.

N79-20686*# National Aeronautics and Space Administration, Washington, D. C.

PERIODIC VARIATIONS OF PRECIPITATION IN THE TROPICAL ATLANTIC OCEAN

M. S. V. Rao (Systems and Appl. Sci. Corp.) and J. S. Theon *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 319-322 refs (For primary document see N79-20633 11-47)

(Paper-53) Avail: NTIS HC A17/MF A01 CSCL 04B

Statistical analysis of the satellite-borne Electrically Scanning Microwave Radiometer data in the tropical Atlantic region reveals that the rainfall near local noon is higher both in frequency of occurrence and intensity than the rainfall in the same area near local midnight. Another striking feature that stands out from the analysis is an oscillation with a period of 3.3. days in rainfall occurrence and intensity. This periodicty is consistent with easterly waves traveling from the African continent to the region under study. Author

N79-20687*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REMOTE SENSING OF SEASONAL DISTRIBUTION OF PRECIPITABLE WATER VAPOR OVER THE OCEANS AND INFERENCE OF BOUNDARY LAYER STRUCTURE

C. Prabhakara *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 323-327 refs (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

Over the ocean satellite infrared spectral measurements in the 18 micrometer water vapor band and the 11 micrometer window region were used to derive precipitable water vapor, w, in the atmosphere and the sea surface temperature, SST. Seasonal maps of w on the oceans derived from these data reveal the dynamical influence of the large scale atmospheric circulation. With the help of a model for the vertical distribution of water vapor, the configuration of the atmospheric boundary layer over the oceans can be inferred from w when the information of SST is combined. The gross seasonal mean structure of the boundary layer inferred in this fashion reveals the broad areas of the trade wind inversion and the convectively active areas such as the intertropical convergence zones. Author

N79-20688*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SOME ASPECTS OF HYDROLOGY IN THE GLAS GCM

R. Godbole *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 329-334 refs (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

The response of hydrology in the Laboratory for Atmospheric Sciences General Circulation Model is evaluated. The results show that the distribution of precipitation agrees fairly well with observations of precipitation and that the model and that the model tends to maintain the hydrological balance. J.M.S.

N79-20689*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ANTARCTIC SEA ICE VARIATIONS 1973 - 1975

H. J. Zwally, C. Parkinson, F. Carsey, P. Gloersen, W. J. Campbell (Geol. Survey, Tacoma, Wash.), and R. O. Ramseier (Dept. of Environment, Ottawa) *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 335-340 refs (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

Variations in the extent and concentration of sea ice cover on the Southern Ocean are described for the three-year period 1973-75 using information derived from the Nimbus-5 passive microwave imager. Author

N79-20690*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

VARIATIONS OF THE EARTH'S MAGNETIC FIELD AND RAPID CLIMATIC COOLING: A POSSIBLE LINK THROUGH CHANGES IN GLOBAL ICE VOLUME

Michael R. Rampino *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 341-345 refs (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

A possible relationship between large scale changes in global ice volume, variations in the earth's magnetic field, and short term climatic cooling is investigated through a study of the geomagnetic and climatic records of the past 300,000 years. The calculations suggest that redistribution of the Earth's water mass can cause rotational instabilities which lead to geomagnetic excursions; these magnetic variations in turn may lead to short-term coolings through upper atmosphere effects. Such double coincidences of magnetic excursions and sudden coolings at times of ice volume changes have occurred at 13,500, 30,000, 110,000, and 135,000 YBP. Author

N79-20691*# Stanford Univ., Calif. Div. of Applied Mechanics.

STOCHASTIC MODELING OF THE TIME-ADVANCED EQUATIONS FOR CLIMATE DYNAMICS

J. A. Laurmann *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 347-353 refs (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

Long term, climatologically significant statistical properties of the atmospheric component of the climate system are examined in an effort to correctly and efficiently incorporate this component into larger models for climate that include oceanic and cryospheric influences and deal realistically with climate replication. The magnetic of the unpredictable (noise) component of long term atmospheric behavior is also studied in order to develop the potential for viable climatological forecasting. J.M.S.

N79-20692*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

A SLAB MODEL FOR COMPUTING GROUND TEMPERATURE IN CLIMATE MODELS

Segej Lebedeff, Gary Crane, and Gary Russell *In* NASA. Goddard Space Flight Center. 4th NASA Weather and Climate Program Sci. Rev. 1979 p 355-359 refs (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

A method is developed for computing the ground temperature accurately over both the diurnal and annual cycles. The ground is divided vertically into only two or three slabs, resulting in very efficient computation. Seasonal storage and release of heat is incorporated, and thus the method is well suited for use in climate models. Author

N79-20693*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

INCORPORATION OF SURFACE ALBEDO-TEMPERATURE FEEDBACK IN A ONE-DIMENSIONAL RADIATIVE-CONNECTIVE CLIMATE MODEL

Wei-chyung Wang and Peter H. Stone (MIT, Cambridge) *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 361-365 refs (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

The feedback between ice snow albedo and temperature is included in a one dimensional radiative convective climate model. The effect of this feedback on sensitivity to changes in solar constant is studied for the current values of the solar constant and cloud characteristics. The ice snow albedo feedback amplifies global climate sensitivity by 33% and 50%, respectively, for assumptions of constant cloud altitude and constant cloud temperature. Author

N79-20694*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A GCM SIMULATION OF THE EARTH-ATMOSPHERE RADIATION BALANCE FOR WINTER AND SUMMER

M. L. C. Wu *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 367-379 refs (For primary document see N79-20633 11-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

The radiation balance of the earth-atmosphere system simulated by using the general circulation model (GCM) of the Laboratory for Atmospheric Sciences (GLAS) is examined in regards to its graphical distribution, zonally-averaged distribution, and global mean. Most of the main features of the radiation balance at the top of the atmosphere are reasonably simulated,

with some differences in the detailed structure of the patterns and intensities for both summer and winter in comparison with values as derived from Nimbus and NOAA (National Oceanic and Atmospheric Administration) satellite observations. Both the capability and defects of the model are discussed. Author

N79-20695*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
MAINTENANCE OF QUASI-STATIONARY WAVES IN A 2-LEVEL QUASI-GEOSTROPHIC SPECTRAL MODEL WITH TOPOGRAPHY
Mao-Sung Yao *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 381-385 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The maintenance of the quasi-stationary waves obtained through numerically integrating a 2-level quasi-geostrophic spectral model on a beta-plane is investigated. An idealized topography which has only wavenumber n in the zonal direction and the first mode in the meridional direction is used to force the quasi-stationary waves. It is shown that the topographical forcing is not necessarily the mechanism for maintaining the quasi-stationary waves. Author

N79-20696*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
USE OF GLOBAL ATMOSPHERIC DATA SETS TO TEST QUASI-GEOSTROPHIC EDDY MOMENTUM FLUX CONVERGENCE
W. J. Heck *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 387-391 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The quasi-geostrophic relation between the fluxes of momentum, potential vorticity, and potential temperature is tested with global sets of atmospheric wind and temperature data by computing the convergence of momentum flux as a residual of the potential temperature and potential vorticity flux and comparing it to the momentum flux convergence computed directly. It is shown that in the troposphere between 18 N and 74 N the observed momentum flux convergence differs from the quasi-geostrophic convergence by 25%-60%, with the larger errors only occurring where the convergence is small. These results indicate that momentum flux convergence obtained from quasi-geostrophic theory is adequate for qualitative studies of the general circulation, and is comparable in accuracy to values obtained in general circulation models. For simple climate models and qualitative process studies, it can thus provide a useful approach. Author

N79-20697*# State Univ. of New York at Purchase.
SPATIAL AND TIME DOMAIN SPECTRAL ENERGETICS IN THE GLAS CIRCULATION MODEL
J. Tenenbaum *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 393-398 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Zonally averaged eddy kinetic energies and time domain energetics spectra were calculated for the GLAS general circulation model. The spatial results show significant improvements in the magnitude and distribution of the eddy kinetic energy. The spectral results provide a technique for tracing when and where the model predictions diverge from observations. J.M.S.

N79-20698*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG-TERM MIGRATION OF THE SOLAR SECTOR STRUCTURE
C. L. Wolff and D. F. Heath *In its* 4th NASA Weather and Climate Program Sci. Rev. 1979 p 399-403 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The magnetic sector boundaries on the sun and in the solar wind are shown to have a high correlation with winter low pressure systems on earth. The vorticity-area index typically declines by about 10% during several days centered on the time when a sector boundary sweeps past the earth. Evidence that both the sector structure and solar activity levels can be understood as being under the influence of the same regular, internal solar mechanism is presented. J.M.S.

N79-20699# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 12832A LANCE MISSILE NO. 3324, ROUND NO. 321 ACT, 20 OCT. 1978 Meteorological Data Report
Nov. 1978 29 p
(DA Proj. 1T6-65702-D-127)
(AD-A062108; ECOM-DR-980) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12832A lance, missile number 3324, round number 321 act, are presented in tabular form. Author (GRA)

N79-20700# Naval Research Lab., Washington, D. C.
MODEL FOR ESTIMATING METEOROLOGICAL PROFILES FROM SHIPBOARD OBSERVATIONS Interim Report
Dec. 1978 34 p refs
(AD-A062836; NRL-8279) Avail: NTIS HC A03/MF A01 CSCL 04/2

A model is presented which estimates the vertical profiles of air temperature, relative humidity, and water-vapor density within the lowest 2 kilometers of the marine atmosphere. Inputs to the model are a subset of standard marine surface observations, obtainable from ships throughout the world ocean. The 1977 EOMET cruise of the USNS Hyes provided a set of kite-balloon measurements of air temperature, relative humidity, and water-vapor density together with standard marine surface observations throughout the North Atlantic Ocean and the Mediterranean Sea. The model estimates of the meteorological parameters are compared with simultaneously obtained in-situ measurements for 56 flights. In some cases agreement is good, but when the profiles change during the 50 minutes required for a kit-balloon measurement, comparison with the static model becomes invalid. Author (GRA)

N79-20701# Environmental Research and Technology, Inc., Concord, Mass.
THIN CIRRUS CLOUD OVER THE TROPICAL PACIFIC
Hsiao-Hua K. Burke, Allan J. Bussey, and Kenneth R. Hardy Oct. 1978 41 p refs
(Contract F19628-76-C-0069)
(AD-A062240; ERT-P-1996-637F; AFGL-TR-78-0259; SR-3)
Avail: NTIS HC A03/MF A01 CSCL 04/2

This report summarizes a theoretical study of the detectability of high altitude (= 10 km) thin cirrus clouds by various remote sensors over the tropical Pacific. The remote sensors considered include: (1) visual detection from the surface, (2) visual detection from an aircraft, and (3) infrared sensor (6.7 micrometers) from space. The radiative transfer technique to compute the atmospheric radiance (intensity) is summarized. The optical properties of ice crystals are presented. The results indicate that the minimum detectable concentration of ice crystals having a dimension greater than 80 micrometers, the critical size which will be hazardous to the RV transition, is around 2 x 10(4) m(-3) for visual detection from the surface and 3-4 x 10(3) m(-3) for both aircraft observation and infrared sensors from space. Author (GRA)

N79-20702# Florida Technological Univ., Orlando. Dept. of Mathematics and Statistics.
SOME MODELS FOR RAINFALL Scientific Report, 31 May 1977 - 31 Aug. 1978
Paul N. Sommerville, Sharon Watkins, and Richard Daley 31 Aug. 1978 43 p refs
(Contract F19628-77-C-0080)
(AD-A062457; AFGL-TR-78-0218) Avail: NTIS HC A03/MF A01 CSCL 04/2

Models are given both for the probability of daily precipitation and for the probability of an 'Extreme Value' for daily precipitation during a given month for each of ten widely distributed stations. Two sets of models are given in each case. Each model in the first set is valid only for a specific month. The models in the second set are applicable to any month of the year. A measure of goodness is given. For daily precipitation, the models are the lognormal and the modified kappa. For extreme values of daily precipitation, the 'Extreme Value' model is used. Author (GRA)

N79-20703# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
ICE FOG SUPPRESSION USING REINFORCED THIN CHEMICAL FILMS
Terry T. McFadden and Charles M. Collins Nov. 1978 28 p
(AD-A063107; CRREL-78-26) Avail: NTIS HC A03/MF A01 CSCL 04/2

Ice fog suppression experiments on the Fort Wainwright Power Plant cooling pond were conducted during the winters of 1974-76. Baseline information studies occupied a sizable portion of the available ice fog weather in 1974-75. Then hexadecanol was added to the pond and dramatically improved visibility by reducing fog generated from water vapor released by the pond at -14 C. Although this temperature was not low enough to create ice fog, the cold vapor fog created was equally as devastating to visibility in the vicinity of the pond. During the winter of 1975-76, suppression tests were continued using films of hexadecanol, mixes of hexadecanol and octadecanol, and ethylene glycol monobutyl ether (EGME). Suppression effectiveness at colder temperatures was studied and limits to the techniques were probed. A reinforcing grid was constructed that prevented breakup of the film by wind and water currents. Lifetime tests indicated that EGME degrades much more slowly than either hexadecanol or the hexadecanol-octadecanol mix. The films were found to be very effective fog reducers at warmer temperatures but still allowed 20% to 40% of normal evaporation to occur. The vapor thus produced was sufficient to create some ice fog and occurred less frequently and was more quickly dispersed than the thick fog that was present before application of the films.
GRA

N79-20704# Nebraska Univ., Lincoln. Dept. of Geography.
ANALYSIS OF SEASONAL PERSISTENCE OF CLIMATE IN NEBRASKA Project Completion Report, 1 Oct. 1977 - 30 Sep. 1978
Merlin P. Lawson, Arthur V. Douglas, and Phillip J. Englehart Oct. 1978 154 p refs
(Contract DI-14-34-0001-8029; OWRT Proj. A-049-NEB(1))
(PB-289226/3; OCCASIONAL-PAPER-4; W79-01538) Avail: NTIS HC A08/MF A01 CSCL 04B

Statistical and synoptic probabilistic models for forecasting seasonal climate in Nebraska are developed. Examination of mid-tropospheric flow patterns indicate cold, wet periods are frequently associated with major trough development in the western plains. Warm, dry seasons are associated with persistent positive height anomalies in the southern and central plains. Seasonal forecasts derived from persistence models alone were within plus or minus one class value 92 percent of the time for temperature contingencies and 78 percent for precipitation predictions.
GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N79-20705# Woods Hole Oceanographic Institution, Mass.
A STUDY OF VELOCITY STRUCTURE IN A MARINE BOUNDARY LAYER - INSTRUMENTATION AND OBSERVATIONS Ph.D. Thesis
John Steven Tochko Dec. 1978 195 p
(Contract N00014-74-C-0262; Grant NSF OCE-76-10523)
(AD-A062842; WHOI-78-90) Avail: NTIS HC A09/MF A01 CSCL 08/3

The design and operation of a unique flow measuring instrument for bottom boundary layer studies in the marine environment is documented. The effectiveness of the instrument in acquiring data with which models of near bottom flows in the ocean can be tested is demonstrated by the results of a field experiment in Vineyard Sound. The instrument uses four sensors which measure the mean and fluctuating parts of the three components of the velocity vector at four heights above the sea bed. The sensors employ the acoustic travel time difference technique, and are designed to minimize sensor-induced flow disturbances. BASS, an acronym for Benthic Acoustic Stress Sensor, has a resolution of .033 cm/sec per least bit, a range of + or - cm/sec, noise of .07 cm/sec in 10 sec, and an estimated accuracy of + or - .5 cm/sec, referred to an in situ zero point. A complete set of velocity measure is made every .750 seconds, each measurement being the vector component averaged over 15 cm. The data is internally recorded on digital cassette tape. Eight hours of continuous data can be recorded. BASS was deployed in a tidal flow in Vineyard Sound at a depth of 10 m where a time series of u, v, and w velocities at 26 cm, 46 cm, 96 cm, and 210 cm above the bottom was recorded.
GRA

N79-20706# Naval Postgraduate School, Monterey, Calif.
MASS, SALT, AND HEAT TRANSPORT IN THE SOUTH PACIFIC M.S. Thesis
Louis Sherfesee, III Sep. 1978 136 p refs
(AD-A062200) Avail: NTIS HC A07/MF A01 CSCL 08/3

Utilizing data from a four month period (SCORPIO Expedition, 1967), an analysis was made of the various characteristics of the South Pacific Ocean. This investigation was based on the primary assumption that the geostrophic approximation was valid. A level of no motion was established at 762m and 1203m for the latitudinal sections of 28 and 43 deg respectively, which satisfied mass and salt continuity requirements. Comprehensive temperature and salinity data extended from the western boundary to the eastern boundary of the South Pacific Ocean, and from the sea surface to the sea floor. Net meridional mass, salt and heat transport values were calculated dependent on a selected level of no motion for each of the latitudinal sections. These transport values were then attributed to specific water masses. The current circulation for the Upper Layer was determined to be anticyclonic while the Bottom Layer was cyclonic. The Upper Layer had a net northern transport at both latitudes, while the Intermediate Layer had a net southern transport at 28 deg S and a northern transport at 43 deg S. The Deep Layer had a net southern transport along both latitudes with the Bottom Layer having a net northward transport.
GRA

N79-20707# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
UNIVERSITY OF VIRGINIA COASTAL INFORMATION
C. Cary Rea, Robert Dolan, Bruce Hayden, and Phyllis Ross Nov. 1978 130 p refs
(Contract N00014-75-C-0480)
(AD-A062608; TR-20) Avail: NTIS HC A07/MF A01 CSCL 08/6

A computer assisted coastal information system has been developed which will refer the user to sources of coastal data on the requested parameters and describe the study which acquired the reference data. Design and structure of the file and access program are described, with flow charts and sample input/output included. Information gathering and record input procedures are discussed.
Author (GRA)

N79-20708# General Sensors, Inc., Fort Washington, Pa.
STUDY OF THE FEASIBILITY OF USING AN ADVANCED OPTO-ELECTRONIC IMAGING TECHNIQUE FOR SAMPLING MID-WATER NEKTON Annual Report, 2 May 1977 - 30 Sep. 1978
Harry Sadjian 30 Nov. 1978 112 p refs
(Contracts N00014-77-C-0344; N00014-78-C-0253)
(AD-A062755; GS-1-78-ONR) Avail: NTIS HC A06/MF A01 CSCL 08/1

The feasibility of identifying mid-water nekton at 100 meters in clear ocean water using a fan shaped laser beam in conjunction with a photodiode array detector in a towed system is examined. It has been found that for myctophids and euphasiids, identification can be made only at ranges of 10 to 20 meters and is vector and light source limited. Calculations are presented that show the need for either computer or optical pattern recognition for the rapid identification and counting of these nekton. Both geometric and bioluminescent characteristics are examined as possible candidates for recognition parameters. At high tow rates (about 10 knots) the need for optical pattern recognition has been found to be necessary. Methods are suggested for both optical pattern recognition and sea water optical characteristics simulation to evaluate developed optical recognition systems for myctophids. An appendix presents general characteristics of mid-water nekton with an analysis of the electronic transmis-

sion requirements and limitations at mid-water depths. A selected bibliography is also presented on mid-water nekton.
Author (GRA)

N79-20709# Evans-Hamilton, Inc., Seattle, Wash. Marine Ecosystems Analysis Program.
SURFACE DRIFTER MOVEMENTS OBSERVED IN PORT ANGELES HARBOR AND VICINITY, APRIL 1978
C. C. Ebbesmeyer, J. M. Cox, and J. M. Helseth Sep. 1978 206 p refs
(Contract NOAA-03-78-B01-49)
(PB-289915/2; NOAA-TM-ERL-MESA-31; NOAA-78112402) Avail: NTIS HC A10/MF A01 CSCL 13B

A field experiment is described in which movements of surface drifters were observed nearshore within a fjord-like estuary, the Inner Strait of Juan de Fuca, Washington. The study area straddles a major sill (Green Point to Victoria) terminating between two prominant spilts (Ediz Hook and Dungeness Spit). For 23-30 April 1978, position and trajectories for three types of drifting objects released primarily in the vicinity of Port Angeles Harbor are reported. Preliminary analysis indicated complex patterns of tidal eddies and a tendency for westerly winds to drive floatable materials onshore. GRA

N79-20710# Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
REVIEW OF INFORMATION REGARDING THE CONSERVATION OF LIVING RESOURCES OF THE ANTARCTIC MARINE ECOSYSTEM Final Report
John L. Bengston 28 Jan. 1978 161 p refs Sponsored by the Marine Mammal Commission
(PB-289496/2; MMC-78/04) Avail: NTIS HC A08/MF A01 CSCL 08A

Available information is summarized on the distribution, abundance, status and interrelationships of the major faunal groups present in the Antarctic marine ecosystem. Although the data are neither extensive nor reliable, they clearly indicate that many species are directly or indirectly dependent upon a single species of krill (Euphausia superba), if not regulated properly, could result in depletion of krill stocks, depletion of whales, seals, birds, fish and squid that are dependent upon krill, and/or undesirable changes in the fundamental structure and dynamics of the ecosystem itself. Thus, the need for an ecosystem approach to research and management is self-evident. GRA

N79-20711# Chesapeake Research Consortium, Inc., Annapolis, Md.
CHESAPEAKE BAY BASELINE DATA ACQUISITION. APPENDIX 11: SHORELINE EROSION Final Report, 1973
Oct. 1978 346 p refs
(Contract EPA-68-01-3994)
(PB-289233/9; EPA-903/9-78-030) Avail: NTIS HC A15/MF A01 CSCL 13B

Researches conducting current research programs relating to shoreline erosion in the Chesapeake Bay estuarine system were identified. The data files were compiled from the Environmental Data Base Directory and reflected data applicable to shoreline erosion from 1973 to the present. The major past, present, or planned monitoring efforts were also identified. The data will aid in the design of future research and monitoring efforts for the Chesapeake Bay. GRA

N79-20653*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ADVANTAGES OF ICE CRYSTAL GROWTH EXPERIMENTS IN A LOW GRAVITY ENVIRONMENT
B. J. Anderson, V. W. Keller, and J. Hallett (Desert Res. Inst.) *In* NASA. Goddard Space Flight Center 4th NASA Weather and Climate Program Sci. Rev. 1979 p 115-120 refs (For primary document see N79-20633 11-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N79-20712 Washington Univ., Seattle.
MULTIPLE TRACER DIFFUSION METHODS FOR THE EVALUATION OF CEREBRAL CAPILLARY PERMEABILITY AND CAPILLARY BLOOD FLOW RATE IN THE RAT Ph.D. Thesis
Howard Brent Clark 1978 118 p
Avail: Univ. Microfilms Order No. 7904177

Two methods are described for quantitating the cerebral vascular extraction fractions of diffusion limited radioactive tracer molecules in the rat. The methods are based on measurement of changes in the ratio of the concentrations of the test tracer H-3-water or H-3-ethanol) and a freely diffusible reference tracer (C-14 butanol) that occur subsequent to differential extraction as the tracers pass through the brain vasculature. One method employs a five microliter injection into the common carotid artery using a specially designed micro-needle that does not disrupt the normal arterial blood flow. The other method, while also nondisruptive to vascular flow, allows, for analysis of all areas of the brain, including regions not supplied by the carotid arteries. Dissert. Abstr.

N79-20713 California Univ., Irvine.
REGULATION OF THE CARBON DIOXIDE TENSION IN ARTERIAL BLOOD DURING INHALATION OF CARBON DIOXIDE IN BIRDS AND MAMMALS Ph.D. Thesis
Gordon Stewart Mitchell 1978 120 p
Avail: Univ. Microfilms Order No. 7901963

The physiological responses of chickens and cats to low levels of inhaled carbon dioxide were studied. In the first series of exeriments, 10 anesthesized male White Leghorn chickens were exposed to partial pressures of carbon dioxide in the inspired gas (P sub ICO2) between 0 and 35 torr. Steady-state measurements of the CO2 tension in the arterial blood (P sub aCO2), the arterial hydrogen ion concentration ([H(+)]) and ventilation were made. The afferent path of IPC is predominantly through the vagus nerve; therefore a second series of experiments were conducted to determine if sensory information from the vagus nerves is necessary for the regulation of P sub aCO2 at low P sub ICO2 in chickens and cats. It is concluded that IPC mediates the ventilatory reflex at low P sub ICO2 in chickens, but if a CO2-sensitive intrapulmonary receptor mediates the reflex in cats, it must, at least in part, follow a nonvagal afferent pathway. Dissert. Abstr.

N79-20714*# National Aeronautics and Space Administration, Washington, D. C.
THE MEDUZA EXPERIMENT: AN ORBITAL COMPLEX TEN WEEKS IN FLIGHT
V. Ovcharov Mar. 1979 6 p Transl. into ENGLISH from Krasnaya Zvezda (USSR), 24 Aug. 1978 p 3 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75394) Avail: NTIS HC A02/MF A01 CSCL 06C

The newspaper article discusses the contribution of space research to understanding the origin of life on Earth. Part of this basic research involves studying amino acids, ribonucleic acid and DNA molecules subjected to cosmic radiation. The results from the Meduza experiment are not all analyzed as yet. The article also discusses the psychological changes in cosmonauts as evidenced by their attitude towards biology experiments in space. Author

N79-20715*# National Aeronautics and Space Administration, Washington, D. C.
PREBIOTIC COORDINATION CHEMISTRY: THE POTENTIAL ROLE OF TRANSITION-METAL COMPLEXES IN THE CHEMICAL EVOLUTION
Mihaly Beck Feb. 1979 28 p refs Transl. into ENGLISH from Kem. Kozlem. (Hungary), v. 5, no. 1-2, 1978 p 223-240 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Lajos Kossuth Univ.
(Contract NASw-3199)
(NASA-TM-75381) Avail: NTIS HC A03/MF A01 CSCL 06C

In approaching the extremely involved and complex problem of the origin of life, consideration of the coordination chemistry appeared not only as a possibility but as a necessity. The first model experiments appear to be promising because of prebiotic-

type synthesis by means of transition-metal complexes. It is especially significant that in some instances various types of vitally important substances (nucleic bases, amino acids) are formed simultaneously. There is ground to hope that systematic studies in this field will clarify the role of transition-metal complexes in the organizatorial phase of chemical evolution. It is obvious that researchers working in the fields of the chemistry of cyano and carbonyl complexes, and of the catalytic effect of transition-metal complexes are best suited to study these aspects of the attractive and interesting problem of the origin of life.
Author

N79-20716# Oregon State Univ., Corvallis. Dept. of Agricultural Chemistry.
METABOLISM OF HYDRAZINE Annual Report, 17 Jan. 1977 - 17 Jan. 1978
F. N. Dost and D. L. Springer Wright-Patterson AFB, Ohio AMRL Sep. 1978 22 p refs
(Contract F33615-77-C-0500; AF Proj. 2312)
(AD-A062251; AMRL-TR-78-47) Avail: NTIS HC A02/MF A01 CSCL 07/3

A closed, vacuum tight animal maintenance system has been devised that enables recovery of very small amounts of respiratory 15N over extended periods. Animals with indwelling cannulas for injection and sampling are placed in a closed, circulating atmosphere of 75% SF6/25% O2. CO2 is removed in a soda lime trap, and O2 is added by a peristaltic pump controlled by a pressure sensitive switch. At the time of collection the animal is euthanized and the atmosphere is circulated through a pyrogallol trap to remove most of the oxygen, then transferred by temperature gradient to a high vacuum system where SF6 if frozen out. Preliminary studies of the disposition of intact hydrazine and its derivatives in rats are described. Substantial amounts of a metabolite tentatively identified as diacetyl hydrazine were found in urine. During continuous infusion of hydrazine, some animals maintained a constant blood hydrazine level, others were unregulated and experienced a continuous increase for the duration of infusion. GRA

N79-20717# Oklahoma Univ. Health Sciences Center, Oklahoma City.
EFFECTS OF METHYLPREDNISOLONE SODIUM SUCCINATE ON CLEARANCE OF LIVINE E. COLI FROM PERIPHERAL BLOOD OF DOGS
Gary L. White, Linda T. Archer, Ora F. Elmore, and Learner B. Hinshaw 28 Aug. 1978 25 p refs
(Contract N00014-76-C-0229)
(AD-A062123; TR-131) Avail: NTIS HC A02/MF A01 CSCL 06/5

Corticosteroids have been reported to potentiate infections, and yet recent clinical and experimental studies have documented their therapeutic effectiveness in both septic and endotoxin shock. This study was designed to determine if methylprednisolone sodium succinate (MP) affects the clearance of live E. coli organisms from peripheral blood of dogs. The experimental group was pretreated with 30 mg/kg of MP while controls received equal volumes of saline. Both control and MP pretreated dogs significantly reduced the number of E. coli in peripheral blood by almost two orders of magnitude; however, there was no significant difference in clearance of E. coli organisms between the two groups. An initial leukopenia occured in both groups after E. coli injections; however, the subsequent development of leukocytosis in the MP group was significantly greater at -6 hours. Rectal temperatures were higher in the MP group from -1 through -4 hours compared with the controls. Hyperglycemia developed initially in both groups followed by a progressive hypoglycemia with survivors returning to near normal blood glucose concentrations. Hemoconcentration occured in both groups with higher hematocrits being associated with mortality. Results support the view that methylprednisolone sodium succinate does not affect the clearance of live E. coli organisms. Author (GRA)

N79-20718# Missouri Univ. -Kansas City. Dept. of Biology.
CITRIC ACID ENHANCEMENT OF COPPER SULFATE TOXICITY TO BLUE-GREEN ALGAE AND OTHER NUISANCE ORGANISMS
Michele S. Stern, Daniel H. Stern, and Lisa L. Ray 30 Nov. 1978 95 p refs
(Contracts DI-14-34-0001-7053; DI-14-34-0001-7054)
(PB-289490/5; W79-01906; OWRT-A-099-MO(2)) Avail: NTIS HC A05/MF A01 CSCL 06T

Copper toxicity tests were carried out using two species of blue-green algae, Aphanizomenon flossquae and Microcystis aeruginosa. Copper concentrations of 300 micrograms/liter or higher inhibited the growth of Aphanizomenon. The addition of 600 micrograms Cu(2+)/liter was the minmum copper concentration necessary to inhibit Microcystis growth over a 14-day experimental period. Copper solubility and cupric ion toxicity were enhanced by the addition of citric acid. A ratio of citric acid at eight times the weight of copper sulfate pentahydrate at a copper concentration of 500 micrograms/liter was inhibitory to Microcystis growth over a 14-day period. The 8:1 mixture had the same effects as the addition of 600 micrograms Cu(2+)/liter.
GRA

N79-20719# Environmental Monitoring and Support Lab., Cincinnati, Ohio.
METHODS FOR MEASURING THE ACUTE TOXICITY OF EFFLUENTS TO AQUATIC ORGANISMS
William Peltier Jul. 1978 62 p refs Revised
(PB-289605/8; EPA-600/4-78-012-REV) Avail: NTIS HC A04/MF A01 CSCL 06T

The methods include a preliminary short-term (8-24 hr), range-finding (screening) test and a long-term (96 hr) flow through, or alternate static, definitive test for use in determining the LC50 or EC50 of the waste. Guidelines for effluent sampling and holding, facilities and equipment, dilution water, test species selection and handling, and data interpretation are reported. GRA

N79-20720# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: BIOMEDICAL AND BEHAVIORAL SCIENCES, NO. 50
18 Dec. 1978 39 p refs Transl. into ENGLISH from various Russian journals
(JPRS-72462) Copyright. Avail: NTIS HC A03/MF A01

Papers are presented on the following topics: (1) agrotechnology - problems of bacterial contamination of the work zone in production of livestock products; (2) clinical medicine - the role of computers and mathematical models in the treatment of heart surgery patients; (3) industrial microbiology - a complex feed additive, and a proposed reorganization of nutrient yeast production; and (4) instruments and equipment - combined aspirator development for air sampling. For individual titles, see N79-20721 through N79-20722.

N79-20721# Joint Publications Research Service, Arlington, Va.
THE ROLE OF COMPUTER TECHNOLOGY MATHEMATICAL MODELS IN TREATMENT OF PATIENTS FOLLOWING HEART SURGERY c52
V. I. Burakovskiy, V. A. Lishchuk, and I. N. Storozhenko *In its* Transl. on USSR Sci. and Technol.: Biomed and Behaviorial Sci., No. 50 (JPRS-72462) 18 Dec. 1978 p 5-17 refs Transl. into ENGLISH from Kardiologiya (Moscow), no. 9, 1978 p 19-26 (For primary document see N79-20720 11-51)
Copyright. Avail: NTIS HC A03/MF A01

Discussion is presented on computer monitoring, automated case histories, automated intensive care, the role of automation in scientific research, and evaluation of patient status and choice of therapy by means of mathematical models. A library of mathematical models and methods is presented for working with patients varying in scope of monitoring. G.Y.

N79-20722# Joint Publications Research Service, Arlington, Va.
NEW COMBINED ASPIRATOR FOR SAMPLING DEVELOPED c54
V. V. Tretyachenko and M. Ya. Nazar *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 50 (JPRS-72462) 18 Dec. 1978 p 23-26 Transl. into ENGLISH from Gig. Tr. Prof. Zabol. (Moscow), no. 9, 1978 p 55-57 (For primary document see N79-20720 11-51)
Copyright. Avail: NTIS HC A03/MF A01

Having studied the most known methods of air sampling on a previous model, an aspirator for air sampling operations

on electric power and automobile engines was developed and introduced into practice. The instrument was designed in such a way that it retains the same dimensions as the previous model but does not have parts mounted on the case. The instrument weight increased by 100 grams. A diagram of the combined aspirator is presented. G.Y.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N79-20723 Lehigh Univ., Bethlehem, Pa.
MATHEMATICAL STUDIES OF OXYGEN TRANSPORT TO TISSUE Ph.D. Thesis
Tseng-Chan Wang 1978 198 p
Avail: Univ. Microfilms Order No. 7904323

A mathematical analysis of oxygen transport to tissue is presented. A conceptual model is used that consists of a single capillary surrounded by a concentric cylinder of tissue. Due to the nonlinearity of the relationship governing the dissociation of oxygen from hemoglobin, a nonlinear system of coupled equations results. These equations describe the convection of oxygen by the flood in the capillary and its diffusion in the surrounding tissue. An analysis of these equations for steady state conditions, using the techniques of matched asymptotic expansions, is presented. The solutions obtained in this way are applicable when the mean capillary spacing is small compared to the capillary length. A corresponding linear problem was solved exactly and the solution used to examine the accuracy of the perturbation solution. Dissert. Abstr.

N79-20724# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
BANDPASS CHANNELS, ZERO-CROSSINGS, AND EARLY VISUAL INFORMATION PROCESSING
D. Marr, T. Poggio, and S. Ullman Sep. 1978 9 p refs
(Contract N00014-75-C-0643; Grant NSF MCS-77-07569)
(AD-A062338; AI-M-491) Avail: NTIS HC A02/MF A01 CSCL 06/4

A recent advance by B. F. Logan in the theory of one octave bandpass signals may throw new light on spatial-frequency-tuned channels in early visual information processing. Author (GRA)

N79-20725# Army Aeromedical Research Lab., Fort Rucker, Ala.
US ARMY AVIATION FATIGUE-RELATED ACCIDENTS, 1971-1977 Final Report
Gerald P. Kruger and Yvonna F. Jones Oct. 1978 31 p refs
(AD-A062486; USAARL-79-1) Avail: NTIS HC A03/MF A01 CSCL 06/5

An accident data survey was made to determine how frequently aviator crew fatigue may have contributed to US Army aviation accidents from 1971 to 1977. All accident reports in the US Army Agency for Aviation Safety (USAAAVS) data base were reviewed. Aviator fatigue was deemed to be a contributing factor in 42 rotary wing accidents which resulted in a total of 51 fatalities and 63 personnel injuries. Fatigue contributed to 10 fixed wing accidents, resulting in 3 fatalities and 5 injuries. This paper categorizes these fatigue related accidents by aircraft and mission type and by time of day and day of week of the accident. It also tabulates pilot activities prior to the accidents which promote the likelihood of pilot fatigue contributions. The personnel and equipment costs of these accidents to the Army are estimated, and the relative importance of such accidents to the total US Army aviation accident picture is assessed.
Author (GRA)

N79-20726# Mason (Virginia) Research Center, Seattle, Wash.
HYPERBARIC DECOMPRESSION BY MEANS OF BUBBLE DETECTION Final Report
Kent H. Smith and Lee Stayton 20 Apr. 1978 146 p refs
(Contract N00014-69-C-0402)
(AD-A062441) Avail: NTIS HC A07/MF A01 CSCL 06/19

Present decompression procedures, based on the Haldane concept, allow the maximum possible degree of supersaturation without producing decompression sickness in an attempt to provide the greatest rate of gas elimination and the shortest possible safe decompression. The initially large supersaturation values experienced in a Haldane type decompression were shown to predispose bubble formation. Using the Doppler detector implanted on the pulmonary artery or posterior vena cava in sheep and goats, we have demonstrated the presence of gaseous emboli in all Haldane model decompressions. Emboli signals from implanted cuffs were clear with a high signal to noise ratio and were therefore adaptable for signal analysis and absolute quantitation with a gas emboli counter. Gas emboli-free ascent procedures were developed using the ultrasonic detector and the emboli counter. These gaseous emboli when detected in large numbers heralded the onset of decompression sickness. Even in small numbers these emboli caused changes in platelet and fibrinogen survival times. We conclude that the most probable cause of bubble formation in a Haldane type decompression is the initial ascent rate and that gas emboli are pathogenic and should be eliminated to provide a truly safe decompression.
Author (GRA)

N79-20727# Syracuse Research Corp., N. Y.
HEALTH EFFECTS ASSOCIATED WITH DIESEL EXHAUST EMISSIONS. LITERATURE REVIEW AND EVALUATION
Joseph Santodonato, Dipak Basu, and Philip Howard Nov. 1978 165 p refs
(Contract EPA-68-02-2800)
(PB-289817/9; EPA-600/1-78-063) Avail: NTIS HC A08/MF A01 CSCL 06T

Engineering tests have show a significant improvement in fuel economy in light duty vehicles equipped with diesel engines versus those equipped with gasoline engines. Automobile manufacturers are considering a major program for conversion to diesel engines in the automobile fleet by 1985. Available studies show rather large differences in emissions from diesel engine exhausts as opposed to gasoline engine exhaust. An assessment of the current state of knowledge regarding the health effects from diesel exhaust emissions, and the identification of major research needs, are important factors. In order to accomplish this objective, the following information on diesel emissions was reviewed: physical and chemical characteristics; biological effects in animals and man; epidemiologic studies; knowledge gaps; and research needs. GRA

N79-20728# Office of Science and Technology, Washington, D. C.
A TECHNICAL REVIEW OF THE BIOLOGICAL EFFECTS OF NON-IONIZING RADIATION
15 May 1978 108 p refs
(PB-290166/8) Avail: NTIS HC A06/MF A01 CSCL 06R

The report is a current statement designed to assist in the future development of a more formal long-term program is reported. Radio-frequency radiation and electro-magnetic fields associated with high-voltage transmission are discussed. GRA

N79-20729# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE AEROSPACE MEDICAL PANEL LONDON SPECIALISTS' MEETING, FALL 1977
Jan. 1979 12 p ref Meeting held at London, 24-28 Oct. 1977
(AGARD-AR-131; ISBN-92-835-1307-X) Avail: NTIS HC A02/MF A01

Methods for early disease detection are required to assure optimum air crew selection criteria and to maintain air crew effectiveness in an increasingly stressful environment. A universal approach to a basic framework for developing prospective medicine programs is far from being defined. Yet, prospective medicine proves of value in risk identification and intervention. Examination techniques for the assessment of cardiopulmonary diseases of flying personnel still shows deficiencies, problems, and the need for further research and development to help solve this important health problem. For individual titles, see N79-20730 through N79-20731.

N79-20730# Air Force Medical Center, Wright-Patterson AFB, Ohio.

PROSPECTIVE MEDICINE OPPORTUNITIES IN AEROSPACE MEDICINE

J. Triebwasser, ed. *In* AGARD Tech. Evaluation Rept. on the Aerospace Med. Panel London Specialists' Meeting Jan. 1979 p 1-3 (For primary document see N79-20729 11-52)
Avail: NTIS HC A02/MF A01

Various applications of prospective medicine techniques to the practice of aerospace medicine are discussed. Studies were conducted in the special population of military aircrew on the prevalence/incidence of findings, including multiple risk assessments, correlation of these with disease risks, and the results of efforts to modify the risk for disease and its clinical manifestations. Major problem areas addressed include: (1) the design and potential value of screening physical examinations and other health appraisal methods for the identification of aircrew members at risk for manifestations of disease having aeromedical significance; (2) methods for modifying risk with emphasis on disease prevention; and (3) definition of the significance of abnormal findings resulting from health appraisals conducted within an apparently healthy aircrew population. A.R.H.

N79-20731# School of Aerospace Medicine, Brooks AFB, Tex. Clinical Sciences Div.

SPECIFIC FINDINGS IN CARDIOLOGY AND PULMONARY FUNCTION WITH SPECIAL EMPHASIS ON ASSESSMENT CRITERIA FOR FLYING

M. C. Lancaster, ed. *In* AGARD Tech. Evaluation Rept. on the Aerospace Med. Panel London Specialists' Meeting Jan. 1979 p 5-7 (For primary document see N79-20729 11-52)
Avail: NTIS HC A02/MF A01

Normal values, natural history, performance of testing methods, assessments of newer techniques for disease detection and definition and, philosophies of determination of flight fitness are discussed in relation to cardiopulmonary problems in flying personnel. Research and development needs within the NATO countries are identified. A.R.H.

N79-20732# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: BIOMEDICAL AND BEHAVIORAL SCIENCES, NO. 59. EFFECTS OF NONIONIZING ELECTROMAGNETIC RADIATION

9 Mar. 1979 56 p refs Transl. into ENGLISH from various Russian Journals
(JPRS-72956) Copyright. Avail: NTIS HC A04/MF A01

The biological (physiological) effects of nonionizing electromagnetic radiation in the forms of magnetic fields, radio waves and microwaves on humans and animals are reported. For individual titles, see N79-20733 through N79-20741.

N79-20733# Joint Publications Research Service, Arlington, Va.

DECREASE IN THE FUNCTIONAL ABILITIES OF THE HEART AS A RESULT OF EXPOSURE OF AN ORGANISM TO AN ELECTROMAGNETIC FIELD OF INDUSTRIAL FREQUENCY

E. V. Prokhvatilo *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 59 (JPRS-79256) 9 Mar. 1979 p 1-4 refs Transl. into ENGLISH from unknown source, contributed by the Kiev Scientific Research Inst. (For primary document see N79-20732 11-52)
Avail: NTIS HC A04/MF A01

Electromagnetic fields (EMP) of industrial frequency, created by high voltage power transmission lines have assumed important significance for hygiene as physical factors in the environment which affect man. This phenomenon is associated with the current rapid development of electromagnetics which requires continual raising of throughput capacity and increasing the range of power transmission lines. The literature indicates an influence of an EMP of industrial frequency on the cardio-vascular system. A study was undertaken to derive an indepth description of the character of cardiac activity changes resulting from exposure to low-intensity EMP of industrial frequency and the functional abilities of the heart during physical stress. In the experiment the biological activity of the heart of rabbits was studied. G.Y.

N79-20734# Joint Publications Research Service, Arlington, Va.

BIOLOGICAL EFFECTS OF A MAGNETIC FIELD

V. M. Aristarkhov *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 59 (JPRS-72956) 9 Mar. 1979 p 5-8 refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 1, 1979 p 122-123 (For primary document see N79-20732 11-52)
Copyright. Avail: NTIS HC A04/MF A01

A critical analysis of certain theoretical approaches to an interpretation of the biological effects of a magnetic field (MF) are presented, adducing two hypotheses: diffusion-oriented influence of the MF on the association of diamagnetoanisotropic molecules of biopolymers in solutions, and the kinetic influence of the MF on biochemical reactions participated in by free radicals. The article corrects some misprints, inaccuracies in formulas, and an error that appeared in two articles with regard to calculations of the potential energy of deformation of the aromatic residue. New approaches are presented for interpreting the possible diamagnetoanisotropic effect of the MF in specifically imbalanced, kinetic, and non-thermodynamic processes involving biopolymers. G.Y.

N79-20735# Joint Publications Research Service, Arlington, Va.

EFFECT OF RADIO WAVES OF A MILLIMETER FREQUENCY RANGE ON THE BODY OF MAN AND ANIMALS

N. P. Zalyubovskaya and R. I. Kiselev *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 59 (JPRS-72956) 9 Mar. 1979 p 9-15 refs Transl. into ENGLISH from Gig. Sanit. (Moscow), no. 8, 1978 p 35-39 (For primary document see N79-20732 11-52)
Copyright. Avail: NTIS HC A04/MF A01

Observations were made of the state of health of 72 engineers and technicians (aged 20 to 50 years) servicing ultrahigh frequency generators of a millimeter frequency range for a period of 1 to 10 years. Observations were for three years and during the winter months a periodic medical and biological examination was given each subject. The workers complained of fatigue, drowsiness, headaches and loss of memory. A more profound clarification of the effect of radio waves on the immunocompetent system and its specific function was the objective of another experiment on animals. The experiment was conducted on 350 mice of the CBA line (250 irradiated and 100 control). Results showed that the irradiated animals leucocyte numbers in the peripheral blood decreased and the indices characterizing the nonspecific resistance of the body changed. The animal experiment confirmed results of the worker experiment. G.Y.

N79-20736# Joint Publications Research Service, Arlington, Va.

IMMUNOLOGICAL EFFECTS OF MICROWAVE ACTION

M. G. Shandala and G. I. Vinogradov *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 59 (JPRS-72956) 3 Sep. 1979 p 16-21 refs Transl. into ENGLISH from Gig. Sanit. (Moscow), no. 10, 1978 p 34-38 (For primary document see N79-20732 11-52)
Copyright. Avail: NTIS HC A04/MF A01

An attempt was made to reveal the reactions of the body's immune system in response to a low intensity SHF superhigh frequency electromagnetic field characterized by different power flux densities (PFD's)--50, 10, 5, and 1 microns/sq cm.. The experimental conditions foresaw daily irradiation of guinea pigs for 30 days in specially outfitted chambers with a Luch-2 apparatus while systematically monitoring the PFD. The immunological analyses were performed prior to irradiation, 2 and 4 weeks after it was begun, and 2, 4, and 8 weeks after termination of exposure. In experiments on guinea pigs, the dynamics of the principal indicators of the body's nonspecific immunological reactivity (the phagocytic reaction of neutrophils in peripheral blood, and the complement titer in blood serum) were studied. G.Y.

N79-20737# Joint Publications Research Service, Arlington, Va.

MAGNETIC FIELD EFFECT ON RADIAL PROCESSES IN BIOLOGICAL MEMBRANES

O. G. Kadnykov, I. I. Zalyubovskyy, V. I. Kobizskyy, and T. I.

Vitovtova *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 59 (JPRS-72956) 9 Mar. 1979 p 22-27 refs Transl. into ENGLISH from Dopov. Akad. Nauk Ukr. RSR, Ser. B (Kiev), no. 10, Oct. 1978 p 927-930 (For primary document see N79-20732 11-52)
Copyright. Avail: NTIS HC A04/MF A01

The effect of magnetic fields on the consumption rate of oxygen in the autooxidation process of unsaturated fatty acids was studied using model membrane structures, the liposomes. The lipids were obtained from white matter of a bull's brain. Results indicate that under the influence of a magnetic field, changes may occur in the reaction kinetics of the free radical oxidation of lipids, which may lead to macroscopical alterations in lipid components of the biomembrane. A brief discussion on the study of magnetically sensitive processes involving enzymes in biomembranes is presented. The magnetic sensitivity of the electron transfer reaction along the respiratory chain and of the related oxidative phosphorylation reactions were investigated. The oxygen consumption of rat's liver mitochondria was determined. G.Y.

N79-20738# Joint Publications Research Service, Arlington, Va.
EFFECT OF DIFFERENT DOSES OF CENTIMETER-BAND ELECTROMAGNETIC OSCILLATIONS OF BIOCHEMILUMINESCENCE OF CENTRAL NERVOUS SYSTEM AND LIVER TISSUES
V. R. Faytelberg-Blank and A. V. Orlova *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 59 (JPRS-72956) 9 Mar. 1979 p 28-32 refs Transl. into ENGLISH from Dopov. Akad. Nauk Ukr. RSR, no. 11, 1978 p 1035-1037 (For primary document see N79-20732 11-52)
Avail: NTIS HC A04/MF A01

The intensity of ultra-weak luminescence was investigated and how the tissues of the central nervous system and liver become enriched with products of peroxide oxidation of lipids under the effect of different doses of a superhigh-frequency electromagnetic field was determined. Experiments were performed on 78 rats under conditions of acute experiment. G.Y.

N79-20739# Joint Publications Research Service, Arlington, Va.
EFFECT OF INFRA-LOW-FREQUENCY MAGNETIC FIELDS ON CELL DIVISION
A. D. Strazhizhovskiy, G. V. Galaktionova, and P. A. Chermnykh *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 59 (JPRS-72956) 9 Mar. 1979 p 33-39 refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 1, 1979 p 124-127 (For primary document see N79-20732 11-52)
Copyright. Avail: NTIS HC A04/MF A01

The effect of an IMF (infrared low-frequency magnetic field) with an intensity of 3-127 koer of one hour duration on the mitotic activity, frequency of chromosomal aberrations, and quantity of cells of the epithelium of a mouse cornea was studied. It is shown that the resulting changes in the mitotic activity can be explained by reversible delay of cell division in the later stages of the mitotic cycle and their synchronic entry into mitosis after the delay is eliminated. The nature of the relation of the effect to the intensity of the IMF testifies to the difference of its molecular mechanisms in the field of high and superhigh intensities. G.Y.

N79-20740# Joint Publications Research Service, Arlington, Va.
THE INFLUENCE OF SHF ELECTROMAGNETIC FIELDS ON THE SECRETORY FUNCTION OF THE STOMACH
N. I. Pospelov *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 59 (JPRS-72956) 9 Mar. 1979 p 40-45 refs Transl. into ENGLISH from Izv. Akad. Nauk Kaz. SSR (USSR), no. 6, 1978 p 75-79 (For primary document see N79-20732 11-52)
Copyright. Avail: NTIS HC A04/MF A01

Taking into account, and influenced by the need for further investigation into the effect of superhigh frequency electromagnetic fields on the quantity and quality of excreted gastric juice in irradiation of the epigastric region, an experimental investigation was undertaken. The observations were conducted in long-term experiments on 14 dogs with isolated stomachs. The results of this experiment are presented and discussed. G.Y.

N79-20741# Joint Publications Research Service, Arlington, Va.
CHANGES IN CALCIUM ION ACTIVITY DUE TO MAGNETIZATION OF SOLUTION AS THE POSSIBLE MECHANISM OF BIOLOGICAL ACTION OF MAGNETIC FIELDS
A. G. Kartashev, V. A. Kalyuzhin, R. A. Plyushch, and A. V. Vokhmintsev *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 59 (JPRS-72956) 9 Mar. 1979 p 46-50 refs Transl. into ENGLISH from Electron Obrab. Mater. (USSR), no. 6, 1978 p 65-68 (For primary document see N79-20732 11-52)
Copyright. Avail: NTIS HC A04/MF A01

A series of experiments was conducted on the effects of magnetized solutions of calcium chloride, magnesium chloride and sodium chloride on the rate of fermentation of glucose by yeast, function of myoneural preparations from the frog, and rate of fibrinolysis of rabbit blood plasma. On the basis of magnetobiological investigations, it is concluded that, in theory, any of the parameters of magnetic fields can be biologically significant. In different series of tests, the magnetic field intensity was discretely changed in the range from 320 to 64,000 A/m, at frequencies of 1 and 50 Hz, with both vertical and horizontal orientation of force lines; the degree of heterogeneity was varied from 20 to 50%. G.Y.

N79-20721# Joint Publications Research Service, Arlington, Va.
THE ROLE OF COMPUTER TECHNOLOGY MATHEMATICAL MODELS IN TREATMENT OF PATIENTS FOLLOWING HEART SURGERY
V. I. Burakovskiy, V. A. Lishchuk, and I. N. Storozhenko *In its* Transl. on USSR Sci. and Technol.: Biomed and Behaviorial Sci., No. 50 (JPRS-72462) 18 Dec. 1978 p 5-17 refs Transl. into ENGLISH from Kardiologiya (Moscow), no. 9, 1978 p 19-26 (For primary document see N79-20720 11-51)
Copyright. Avail: NTIS HC A03/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N79-20742# Minnesota Univ., Minneapolis. Dept. of Psychology.
A CONSTRUCT VALIDATION OF ADAPTIVE ACHIEVEMENT TESTING
Isaac I. Bejar and David J. Weiss Nov. 1978 38 p refs (Contract N00014-76-C-0627; RR0420401)
(AD-A063148; RR-78-4) Avail: NTIS HC A03/MF A01 CSCL 05/10

The construct validities of conventional paper-and-pencil and adaptive achievement tests were compared using data from two independent groups of 269 and 230 college students. Two adaptive achievement tests were computer administered to each group using the stradaptive testing strategy; each group also completed two conventional classroom paper-and-pencil achievement tests. All achievement tests were drawn from the same pool of achievement test items on which item characteristic curve (ICC) parameters had been determined. Students were also administered two stradaptive vocabulary tests. All tests were scored by maximum likelihood estimation using the three-parameter logistic model. A nomological net was specified describing the relationships of the achievement tests to the achievement constructs and their relationships with the vocabulary construct and the vocabulary tests. The parameters of the net were estimated by fitting the observed intercorrelations among the test scores to the nomological net, using the methodology of linear structural equations. Maximum likelihood estimates of the parameters of the nomological net indicated essentially equal validities for the classroom and adaptive tests in four comparisons. The results of this study indicate that computer-administered

adaptive tests can provide more valid measurement of achievement than conventional paper-and-pencil tests. GRA

N79-20743# Air Force Human Resources Lab., Brooks AFB, Tex.
AIR-TO-AIR COMBAT SKILLS: CONTRIBUTION OF PLATFORM MOTION TO INERTIAL TRAINING Final Report, Jan. - May 1977
Lawrence D. Pohlmann and John C. Reed Oct. 1978 25 p refs
(AF Proj. 1123)
(AD-A062738; AFHRL-TR-78-53) Avail: NTIS HC A02/MF A01 CSCL 15/3

This study was conducted to assess the contribution of six-degrees-of-freedom platform motion to the training effectiveness of the Simulator for Air-to-Air Combat(SAAC) for training initial air-to-air combat skills. A transfer-of-training scheme was used. Two classes of Air Force pilots receiving initial training in the F-4 aircraft were divided into three groups. Two of the groups (eight pilots each) received training in Basic Fighter Maneuvers(BFM) using the SAAC, one group using platform motion and the other group not using platform motion. The remaining group (six pilots) did not receive SAAC training. All three groups followed the same syllabus in the aircraft. Instructor pilot ratings of student performance on BFM tasks in the simulator and in four aircraft sorties for each student were collected. Analyses of Variance (ANOVAs) of ratings in the simulator were used to assess initial differences and learning effects in the simulator. ANOVAs of ratings in the aircraft were used to assess transfer of training effects. Although learning effects in both simulator and aircraft were noted, the data did not show a transfer of training effect. For the tasks investigated, SAAC trained students did not perform better than those who did not receive SAAC training. Performance differences between the Motion and No-Motion groups were negligible. Potential reasons for this non-effectiveness, and possible simulator and training program modifications for improving this training effectiveness, are discussed. Author (GRA)

N79-20744# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE RELATIONSHIP BETWEEN AIR COMBAT MANEUVERING RANGE (ACMR) OUTPUT MEASURES AND INITIAL VISUAL ACQUISITION PERFORMANCE
Charles W. Hutchins, Jr. Aug. 1978 20 p ref
(ZF51524004)
(AD-A062134; NAMRL-SR-79-1) Avail: NTIS HC A02/MF A01 CSCL 17/8

Initial visual acquisition of the adversary aircraft is a critically important task in air combat engagements. In order to assess capabilities for the performance of this task, it is necessary to identify the physical/flight variables which impact this performance. Measures of 33 flight variables were recorded at the time of initial visual acquisition. Linear regression analysis was utilized to determine the relationship of each variable to acquistion range. Factor analysis revealed a clustering of the variables into four major factors: relative direction, target velocity, fighter velocity, and relative altitude. A multiple regression analysis was conducted, using these factors to predict acquistion range. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N79-20745*# National Aeronautics and Space Administration, Washington, D. C.
SALYUT-6--SOYUZ-29: OUR COMMENTARY, THE CREW AND THE STATION
V. Kravets Mar. 1979 6 p Transl. into ENGLISH from Pravda (USSR), No. 199, 18 Jul. 1978 p 3 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75393) Avail: NTIS HC A02/MF A01 CSCL 05I

A newspaper article written by an assistant flight director which stresses the importance of cosmonaut training is presented. The preliminary stage of training is discussed, and the training of a crewmaker on a real spacecraft is briefly covered. The success in training foreign cosmonauts by Soviets is also discussed. The author feels that training is even more important today than it was seven or eight years ago because of the increased complexity of the experiments and the length of time a cosmonaut spends in space now. G.Y.

N79-20746*# National Aeronautics and Space Administration. Pasadena Office, Calif.
TERMINAL GUIDANCE SENSOR SYSTEM Patent Application
Antal K. Bejczy, inventor (to NASA) (JPL) Filed 23 Mar. 1979 20 p
(Contract NAS7-100)
(NASA-Case-NPO-14521-1; US-Patent-Appl-SN-023439) Avail: NTIS HC A02/MF A01 CSCL 05H

A system is described for guiding a claw to the proper distance and into the proper orientation in yaw and pitch, to engage a grappling fixture. The system includes four proximity sensors on the claw, that are arranged at the corners of an imaginary square, which sense the distance to the top surface of the grappling fixture. It a pair of sensors at opposite corners of the square sense a different distance to the top surface of the grappling fixture, then it is known that the claw is rotated about a corresponding axis with respect to the plane of the grappling fixture. NASA

N79-20747# Cincinnati Univ., Ohio. Dept. of Engineering Science.
MULTIBODY DYNAMICS INCLUDING TRANSLATION BETWEEN THE BODIES, WITH APPLICATION TO HEAD-NECK SYSTEMS Technical Report, 1 Oct. 1976 - 30 Sep. 1978
Ronald L. Huston and Chris E. Passarello 15 Sep. 1978 64 p refs
(Contract N00014-76-C-0139)
(AD-A062114; UC-ES-091578-7-ONR) Avail: NTIS HC A04/MF A01 CSCL 20/11

This report presents new and recently developed concepts which are useful for obtaining and solving equations of motion of multibody mechanical systems with translation between the respective bodies of the system. These concepts are then applied in the study of human/neck systems in high acceleration configurations. The developed concepts include the use of Euler parameters, Lagrange's form of d'Alembert's principle, quasi-coordinates, relative coordinates, and body connection arrays. This leads to the development of efficient computer algorithms for the coefficients of the equations of motion. The developed procedures are applicable to 'chain-link' systems such as finite-segment cable models, mechanisms, manipulators, robots, and human body models. The application with human head/neck models consists of a 54 degree of freedom, three-dimensional system representing the head, the vertebrae, and the connecting discs, muscles, and ligaments. The computer results for the system in a high acceleration configuration agree very closely with available experimental data. Author (GRA)

N79-20748# School of Aerospace Medicine, Brooks AFB, Tex.
FIGHTER INDEX OF THERMAL STRESS: RELATION TO WEATHER CONDITIONS AT ATC AND TAC BASES Interim Report, Sep. 1977 - Sep. 1978
Sarah A. Nunneley and Richard F. Stribley Nov. 1978 26 p refs
(AF Proj. 7930)
(AD-A062713; SAM-TR-78-33) Avail: NTIS HC A03/MF A01 CSCL 06/19

The Fighter Index of Thermal Stress (FITS) is a tool recently developed for minimizing hazardous aircrew heat stress during hot-weather operations. The FITS table, entered with ground dry bulb temperature (Tdb) and dewpoint temperature (Tdp), yields a numerical estimate of cockpit heat stress. Superimposed on the table are Normal, Caution, and Danger Zones, with footnotes recommending appropriate precautions. This report examines the relationship of FITS to typical weather conditions at 30 ATC

and TAC bases in the continental United States. An appendix presents a graph for each base, indicating the frequency of readings in the Caution and Danger Zones for each hour of the day and month of the year. GRA

N79-20749# Hughes Aircraft Co., Culver City, Calif. Display Systems Lab.
BINOCULAR HOLOGRAPHIC HELMET MOUNTED DISPLAY
Final Technical Report, Oct. 1977 - Sep. 1978
R. E. Heineman, L. W. Bradford, and R. A. Lohmann Dec. 1978 67 p
(Contract N62269-77-C-0504)
(AD-A062761; HAC-P78-538; HAC-REF-E1639; NADC-77228-30) Avail: NTIS HC A04/MF A01 CSCL 20/6

This report describes the application of diffraction optics to the design of a helmet mounted display which permits binocular viewing of a dual fiber optics image source. Author (GRA)

N79-20432*# Planning Research Corp., Kennedy Space Center, Fla.
ADVANCED LIFE SUPPORT EQUIPMENT FOR NITROGEN TETROXIDE ENVIRONMENTS
George H. Bowman, III *In* NASA. Kennedy Space Center Proc. of the NASA/Fla. Inst. of Tech. Environ. Eng. Conf. on Nitrogen Tetroxide Jun. 1978 p 159-182 refs (For primary document see N79-20424 11-42)
Avail: NTIS HC A10/MF A01 CSCL 06K

N79-20722# Joint Publications Research Service, Arlington, Va.
NEW COMBINED ASPIRATOR FOR SAMPLING DEVELOPED
V. V. Tretyachenko and M. Ya. Nazar *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 50 (JPRS-72462) 18 Dec. 1978 p 23-26 Transl. into ENGLISH from Gig. Tr. Prof. Zabol. (Moscow), no. 9, 1978 p 55-57 (For primary document see N79-20720 11-51)
Copyright. Avail: NTIS HC A03/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N79-20750*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLAUSIBLE INFERENCE: A MULTI-VALUED LOGIC FOR PROBLEM SOLVING
Leonard Friedman Mar. 1979 26 p refs
(Contract NAS7-100)
(NASA-CR-158424; JPL-Pub-79-11) Avail: NTIS HC A03/MF A01 CSCL 12A

A new logic is developed which permits continuously variable strength of belief in the truth of assertions. Four inference rules result, with formal logic as a limiting case. Quantification of belief is defined. Propagation of belief to linked assertions results from dependency-based techniques of truth maintenance so that local consistency is achieved or contradiction discovered in problem solving. Rules for combining, confirming, or disconfirming beliefs are given, and several heuristics are suggested that apply to revising already formed beliefs in the light of new evidence. The strength of belief that results in such revisions based on conflicting evidence are a highly subjective phenomenon. Certain quantification rules appear to reflect an orderliness in the subjectivity. Several examples of reasoning by plausible inference are given, including a legal example and one from robot learning. Propagation of belief takes place in directions forbidden in formal logic and this results in conclusions becoming possible for a given set of assertions that are not reachable by formal logic. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N79-20751* National Aeronautics and Space Administration. Pasadena Office, Calif.
DIGITAL DATA REFORMATTER/DESERIALIZER Patent
Alexander Engel (JPL) and L. Richard Springer, inventors (to NASA) (JPL) Issued 13 Feb. 1979 9 p Filed 18 Mar. 1977 Supersedes N77-24781 (15 - 15, p 2034) Sponsored by NASA
(NASA-Case-NPO-13676-1; US-Patent-4,139,839; US-Patent-Appl-SN-779415; US-Patent-Class-340-347DD; US-Patent-Class-364-900) Avail: US Patent and Trademark Office CSCL 09B

A method and apparatus is presented for reformatting and de-serializing a serially-received sequence of data words, each consisting of a fixed number of binary data bits. A block of nm bits is serially fed into a shift register or serially-connected group of shift registers. In lieu of the(nm-1)th shifts, the bits are rearranged within the shift register in parallel fashion, according to a prescribed scheme. Shifting then continues, until the first bit of each data word appears in the last bit position in the shift register, at which time that data word is shifted in parallel into an output buffer stage, from which it is outputted in parallel, after a fixed delay.

Official Gazette of the U.S. Patent and Trademark Office

N79-20752*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LEWIS HYBRID COMPUTING SYSTEM, USERS MANUAL
William M. Bruton and David S. Cwynar Apr. 1979 91 p
(NASA-TM-79111; E-9938) Avail: NTIS HC A05/MF A01 CSCL 09B

The Lewis Research Center's Hybrid Simulation Lab contains a collection of analog, digital, and hybrid (combined analog and digital) computing equipment suitable for the dynamic simulation and analysis of complex systems. This report is intended as a guide to users of these computing systems. The report describes the available equipment' and outlines procedures for its use. Particular is given to the operation of the PACER 100 digital processor. System software to accomplish the usual digital tasks such as compiling, editing, etc. and Lewis-developed special purpose software are described. Author

N79-20753*# Massachusetts Inst. of Tech., Cambridge.
THE DIGITAL IMPLEMENTATION OF CONTROL COMPENSATORS: THE COEFFICIENT WORDLENGTH ISSUE
Paul Moroney, Alan S. Willsky, and Paul K. Houpt Apr. 1979 36 p refs
(Grant NGL-22-009-124)
(NASA-CR-158445; LIDS-P-897) Avail: NTIS HC A03/MF A01 CSCL 09B

There exists a number of mathematical procedures for designing discrete-time compensators. However, the digital implementation of these designs, with a microprocessor for example, has not received nearly as thorough an investigation. The finite-precision nature of the digital hardware makes it necessary to choose an algorithm (computational structure) that will perform 'well-enough' with regard to the initial objectives of the design. This paper describes a procedure for estimating the required fixed-point coefficient wordlength for any given computational structure for the implementation of a single-input single-output LOG design. The results are compared to the actual

number of bits necessary to achieve a specified performance index. Author

N79-20754# Syracuse Univ., N. Y.
DATA SYNCHRONIZATION SCHEMES FOR MULTIPLE COPIED DATA BASES Final Technical Report, Jan. - Jun. 1978
Chin-Hwa Lee Griffiss AFB, N.Y. RADC Dec. 1978 143 p refs
(Contract F30602-75-C-0121; AF Proj. 5597)
(AD-A062967; RADC-TR-78-240) Avail: NTIS HC A07/MF A01 CSCL 09/2

In the network environment with distributed multiple-copied files, a lockout mechanism is required to guarantee the data synchronization. File access requests from geographically dispersed computer nodes have to be coordinated to maintain consistency of multiple-copied files. The advantages of a multiple-copied file in a lossely coupled computer communication network are its reliability to partial network failures and good response to real time file manipulation. In this report, the fundamental problems relating to the lockout synchronization of a multiple-copied file are presented from a new point of view. It can be shown that the file lockout state of the distributed multiple copes is an inherent characteristic of the file manipulation operations. The objective of this work was to determine the performance of data synchronization techniques in the maintenance of distributed multiple-copied files in a computer network using G.P.S.S. simulation. The system visualized is a set of identical copies of a file residing in nodes that form a computer network. Each file is supervised by a Local File Manager (L.F.M.) which is under a control scheme to maintain the congruency and consistency of these files by synchronizing the file access and updating information. This is achieved by locking out the file copes once an L.F.M. was granted the right of updating a file for a particular user. Author (GRA)

N79-20755# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
DEVELOPMENT OF A DATA DICTIONARY: FOR USE IN A DISTRIBUTED INTEGRATED DATABASE M.S. Thesis
Gordon K. Powell Aug. 1978 99 p
(AD-A062716; AFIT-CI-79-84) Avail: NTIS HC A05/MF A01 CSCL 09/2

A data dictionary was developed that can be used on an integrated database that is geographically distributed. The content, logical representation, and physical representation of the data dictionary were presented. A study of the best way to distribute this dictionary was made by simulating several proposed distributions. Thousands of messages were run against each simulated distribution. The best distribution was found after determining the average response time of a message. Author (GRA)

N79-20756# Yale Univ., New Haven, Conn. Dept. of Computer Science.
MEMORY ORGANIZATION FOR NATURAL LANGUAGE DATA BASE INQUIRY
Jane L. Kolodner Sep. 1978 43 p refs
(Contract N00014-75-C-1111)
(AD-A062974; RR-142) Avail: NTIS HC A03/MF A01 CSCL 05/2

A natural language data-base query system, called CYRUS, is described. It stores and retrieves biographical information about people, making use of knowledge structures such as scripts and role themes in order to store the information in memory and guide the question answering process. Author (GRA)

N79-20757# Naval Postgraduate School, Monterey, Calif.
HIGH SPEED DATA ACQUISITION SYSTEM M.S. Thesis
Mack Taylor Elliott Sep. 1978 192 p refs
(AD-A062196) Avail: NTIS HC A09/MF A01 CSCL 09/2

This paper describes the expansion and modification of an existing data acquisition system to effect extensive improvements in speed and flexibility. A microprocessor, flexible disk drive, analog to digital converter, direct memory access module, and high-speed line printer were integrated and interfaced to an IBM 360 digital computer with a high-speed data transmission line. The resultant system provided the capability of digitizing up to sixteen analog inputs simultaneously at rates in excess of 45,000 samples per second. The experimental data could be transmitted expeditiously to the IBM 360 computer for efficient manipulation. Additional benefits gained from the system were its capabilities as a remote terminal for the IBM 360 and a typewriter-quality word processor. The data acquisition and reduction system was qualified for functional performance and speed through a series of test exercises. The word processor was demonstrated in the production of this document. Author (GRA)

N79-20758# Army Construction Engineering Research Lab., Champaign, Ill.
A SURVEY OF THE PROPERTIES OF COMPUTER COMMUNICATION PROTOCOLS. VOLUME 1: THE FUNCTION, PROPERTIES, SPECIFICATION, AND ANALYSIS METHODS OF COMPUTER COMMUNICATION PROTOCOLS Final Report
Avrum E. Itzkowitz Sep. 1978 45 p refs
(AD-A063092; CERL-TR-O-1-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report is a two-part study on the properties of computer communication protocols. This volume focuses on the function and properties of current computer communication protocols. Many different approaches to the specification and analysis problem, ranging from textual description to formal graphical techniques, are presented and discussed. Author (GRA)

N79-20759# Harry Diamond Labs., Adelphi, Md.
SMARTE: A COMPUTER PROGRAM FOR MANAGEMENT AND ANALYSIS OF ELECTROMAGNETIC PULSE TEST DATA
Thomas A. Rose Nov. 1978 197 p refs
(AD-A063079; HDL-TR-1869) Avail: NTIS HC A09/MF A01 CSCL 09/2

The SMARTE computer program, Release 2, is a specialized data base management and analysis program designed to process scientific data consisting of sets of amplitude versus time or amplitude and phase versus frequency coordinates. The data management capabilities allow for the creation, deletion, and editing of records. Records may be retrieved either explicitly by name or by conditional searches on record item values. Retrieved records may be (1) dumped to a storage device for later processing by other programs, (2) used as the subject of built-in and user specified reports, or (3) further analyzed with built-in analysis algorithms. The built-in analysis capabilities allow for the scaling, shifting, and combining of records. Additionally, Fourier transforms can be generated for time records. Each record may contain up to 512 coordinates. Each record also contains space for 128 items of descriptive information. One to five data bases can be controlled. Each data base can contain up to 90,000 records, where the actual limit depends on record size and storage capacity of the peripheral device employed for the data base. This document describes Release 2 of the SMARTE program, which is compatible with IBM 370 computer systems. GRA

N79-20760# Advisory Group for Aerospace Research and Development, Paris (France).
COMPUTER AID IN THE PRODUCTION DESIGN OFFICE
Jan. 1979 56 p In ENGLISH and partly in FRENCH Papers presented at the 47th Meeting of the AGARD Struct. and Mater. Panel, Florence, 25-26 Sep. 1978
(AGARD-CP-250; ISBN-92-835-0229-9) Avail: NTIS HC A04/MF A01

The requirements with respect to software and hardware from different points of view and the close relationship between CAD and CAM are presented. The application of CAD to special systems and components of an aircraft is covered. For individual titles, see N79-20761 through N79-20767.

N79-20761# Computer Aided Design Centre, Cambridge (England).
GRAPHICAL NC SYSTEMS AS A BASIS FOR PROGRESS TOWARDS THE INTEGRATION OF DESIGN, PLANNING AND MACHINING
B. Gott *In* AGARD Computer Aid in the Production Design Office Jan. 1979 8 p (For primary document see N79-20760 11-60)

Avail: NTIS HC A04/MF A01

The systems described are concerned with piece parts on production and design for production. Numerical control of programming, machining, and graphical methods in the computer aided and manufacture throughout all sectors of industry. S.E.S.

N79-20762# Societe Nationale Industrielle Aerospatiale, Marignane (France.)

A COMPUTER AIDED DESIGN AND FABRICATION SYSTEM ADAPTED TO THE DESIGN OF THREE DIMENSIONAL OBJECTS [UN SYSTEME DE CONCEPTION ET FABRICATION ASSISTEES PAR ORDINATEUR ADAPTE A LA CONCEPTION DES OBJECTS TRIDIMENSIONNELS]

Monique Slissa *In* AGARD Computer Aid in the Production Design Office Jan. 1979 5 p In FRENCH (For primary document see N79-20760 11-60)

Avail: NTIS HC A04/MF A01

Computer aided design and fabrication relies on all the capabilities of a data processor to create a product at the least cost, as rapidly as possible, and to provide for modifications in the shortest period of time. For its application, the Helicopter Division of Aerospatiale chose the design of three dimensional objects. A FORTRAN program developed in the Scientific Information Service and used in industry since 1974, permits the creations and modification of simple and complex forms with the assistance of interactive graphic and alphanumeric screens. Development proceeds by taking into consideration the experience acquired by users. Favorable comparisons have been made with traditional methods. In order to rationalize the management of the created objects, an introduction to a new type of data base management system is under study.

Transl. by A.R.H.

N79-20763# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

DRAPO: A COMPUTER AIDED DESIGN AND FABRICATION SYSTEM [DRAPO: UN SYSTEME DE CONCEPTION ET DE FABRICATION ASSISTEES PAR ORDINATEUR]

Francis Bernard *In* AGARD Computer Aid in the Production Design Office Jan. 1979 12 p (For primary document see N79-20760 11-60)

Avail: NTIS HC A04/MF A01

The search for maximum optimization in the construction of aircraft of greater and greater complexity led to the use of a totally integrated system of computerized design and fabrication. Known as DRAPO, the system can be defined partly by the material adopted whose choice determines the mode of utilization, and partly by its principal functions: form definition curves, surfaces, and volume. The motivations and research objects prompting the use of the system are summarized. Its principal aspects are described and its use is demonstrated in several examples. Transl. by A.R.H.

N79-20764# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).

SOME REQUIREMENTS FOR A COMMUNICATION SYSTEM GUIDING THE RELATIONS BETWEEN THE DESIGN ENGINEER AND A GENERAL DATA BASE

W. Lehnert *In* AGARD Computer Aid in the Production Design Office Jan. 1979 4 p (For primary document see N79-20760 11-60)

Avail: NTIS HC A04/MF A01

Complete support of the designer in all phases of the design process is provided. A model for possible cooperation during the development of the communication system is described in order to achieve standardized components. S.E.S.

N79-20765# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

CAD FOR ELECTRIC SYSTEMS DESIGN

Guenter Broll *In* AGARD Computer Aid in the Production Design Office Jan. 1979 8 p (For primary document see N79-20760 11-60)

Avail: NTIS HC A04/MF A01

The large amount of paper work prepared by aircraft production for high performance aircraft design is presented. CAD is designed to meet the needs with respect to speed, reliability, and costs savings. The electric design data is defined by standards, supplier lists, and specifications. The data is converted into drawings and information for production to reach scheduled run times. S.E.S.

N79-20766# Aeritalia S.p.A., Torino (Italy).

AERITALIA POINT OF VIEW AND OBJECTIVES ON COMPUTER AIDED DESIGN

M. Castagneri *In* AGARD Computer Aid in the Production Design Office Jan. 1979 7 p (For primary document see N79-20760 11-60)

Avail: NTIS HC A04/MF A01

A analysis of the usage of computer aids in the design and manufacturing areas is presented. A guideline to improve and collect all the computer programs includes the following features: (1) to bulid up a system administrating a unique data base; (2) to optimize flow times, manpower requirements, and (3) to increase cost benefits. S.E.S.

N79-20767# British Aerospace Aircraft Group, Weybridge (England).

A DISCUSSION OF THE PRODUCTION DESIGN OFFICE BENEFITS OF C.A.D.

L. H. Dyson *In* AGARD Computer Aid in the Production Design Office Jan. 1979 4 p (For primary document see N79-20760 11-60)

Avail: NTIS HC A04/MF A01

Mathematical models representing the different trends in the aircraft industry are presented. The different design phases, design processes, improvements, production engineering, cost reductions, data bases are reported. S.E.S.

N79-20024# Hughes Aircraft Co., Canoga Park, Calif. Missiles Systems Group.

EXPENDABLE DIGITAL COMPUTERS IN TACTICAL MISSILE TRENDS AND TRADEOFFS IN SOFTWARE AND HARDWARE

H. A. Maurer and K. S. Kongelbeck *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 9 p (For primary document see N79-20009 11-01)

Avail: NTIS HC A11/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N79-20768*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PRELIMINARY ISIS USERS MANUAL

Carolyn Grantham Feb. 1979 66 p ref

(NASA-TM-78812) Avail: NTIS HC A04/MF A01 CSCL 09B

The Interactive Software Invocation (ISIS), an interactive data management system, was developed to act as a buffer between the user and host computer system. The user is provided by ISIS with a powerful system for developing software or systems in the interactive environment. The user is protected from the idiosyncracies of the host computer system by providing such a complete range of capabilities that the user should have no need for direct access to the host computer. These capabilities are divided into four areas: desk top calculator, data editor, file manager, and tool invoker. S.E.S.

N79-20769*# Analytic Sciences Corp., Reading, Mass.

USERS MANUAL FOR LINEAR TIME-VARYING HELICOPTER SIMULATION (PROGRAM TVHIS)

Michael R. Burns Mar. 1979 86 p refs

(Contract NAS1-14358)

(NASA-CR-159020) Avail: NTIS HC A05/MF A01 CSCL 09B

A linear time-varying helicopter simulation program (TVHIS) is described. The program is designed as a realistic yet efficient helicopter simulation. It is based on a linear time-varying helicopter model which includes rotor, actuator, and sensor models, as well as a simulation of flight computer logic. The TVHIS can

generate a mean trajectory simulation along a nominal trajectory, or propagate covariance of helicopter states, including rigid-body, turbulence, control command, controller states, and rigid-body state estimates. J.M.S.

N79-20770# Argonne National Lab., Ill. Applied Mathematics Div.

EVALUATING COMPUTER PROGRAM PERFORMANCE ON THE CRAY-1

Larry Rudsinski and Gail W. Pieper Jan. 1979 31 p refs
(Contract W-31-109-eng-38)
(ANL-79-9) Avail: NTIS HC A03/MF A01

The experiences and various techniques for improving run times on the CRAY-1 computer are described and discussed. Direct translation of code from scaler to vector processor reduced running times. Minor code changes were made to facilitate compiler recognition of the parallel and vector structure within the programs. Extensive rewriting of the FORTRAN code structure reduced execution time. Results indicate that the CRAY-1 would be of great benefit to the researchers. The CRAY-1 would permit scientists to investigate complex problems currently deemed infeasible on traditional scalar machines. S.E.S.

N79-20771# Stanford Univ., Calif.

AN EFFICIENT MATRIX FACTORIZATION FOR DIGITAL IMAGE PROCESSING

C. B. Moler and G. W. Steward (Maryland Univ., College Park) Los Alamos, N. Mex. LASL Jan. 1979 17 p refs
(Contract W-7405-eng-36)
(LA-7637-MS) Avail: NTIS HC A02/MF A01

The PDQ factorization method that requires much less arithmetic and does not require the matrix to be stored in the main memory is described. The application of PDQ to image representation, image restoration, and image enhancement are reported. S.E.S.

N79-20772# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

THE REVISED REPORT ON SCHEME: A DIALECT OF LISP

Guy Lewis Steele, Jr. and Gerald Jay Sussman Jan. 1978 37 p refs
(Contract N00014-75-C-0643)
(AD-A062363; AI-M-452) Avail: NTIS HC A03/MF A01 CSCL 09/2

SCHEME is a dialect of LISP. It is an expression-oriented, applicative order, interpreter-based language which allows one to manipulate programs as data. It differs from most current dialects of LISP in that it closes all lambda-expressions in the environment of their definition or declaration, rather than in the execution environment. This has the consequence that variables are normally lexically scoped, as in ALGOL. However, in contrast with ALGOL, SCHEME treats procedures as a first-class data type. They can be the values of variables, the returned values of procedures, and components of data structures. Another difference from LISP is that SCHEME is implemented in such a way that tail-recursions execute without net growth of the interpreter stack. The effect of this is that a procedure call behaves like a GOTO, and thus procedure calls can be used to implement iterations, as in PLASMA. A complete 'user manual' for the SCHEME language is given. Some features described here were not documented in the original report on SCHEME (for instance particular macros). Other features were added, changed, or delected as our understanding of certain language issues evolved. Annotations to the manual describe the motivations for these changes. GRA

N79-20773# Command and Control Technical Center, Washington, D. C.

THE INTERPRETIVE STRUCTURAL MODELING SYSTEM

John R. Scott and Gary A. John 1 Sep. 1978 52 p
(AD-A062297; AD-E100123; CCTC-TM-191-78) Avail: NTIS HC A04/MF A01 CSCL 09/2

The interpretive structural modeling process transforms unclear, poorly articulated mental models of systems into visible, well-defined models useful for many purposes. This is done through the systematic iterative application of graph theory to produce a directed graph of a particular contextual relationship among an element set. This manual briefly describes interpretive structural modeling, then documents an interactive computer program developed to assist in the modeling process. The program is written in FORTRAN and operates on a Honeywell H6000 under GCOS TSS. Author (GRA)

N79-20774# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Civil Engineering.

NUMERICAL AND SOFTWARE REQUIREMENTS FOR GENERAL NONLINEAR FINITE ELEMENT ANALYSIS Ph.D. Thesis

R. H. Dobbs, Jr., L. A. Lopez, and D. A. Pecknold Sep. 1978 216 p refs
(Contract N00014-75-C-0164)
(AD-A062161; SRS-454; UILU-ENG-78-2020) Avail: NTIS HC A10/MF A01 CSCL 09/2

In this work, the theoretical formulations are again considered, however, primary emphasis has been placed on design and implementation of the computer software. The governing equations of nonlinear continuum mechanics, usually expressed in tensor form, are given in matrix notation familiar to most structural engineers. Both geometric and material nonlinearities are considered. The classical equations of the Lagrangian description are cast into the finite element method. Specific matrices are given for large deformations of a three dimensional solid to illustrate the procedure. A general purpose, user-oriented software system, FINITE, for static linear and nonlinear analysis is described. FINITE relies upon the POLO supervisor for problem-oriented-language translation, data management, and dynamic memory allocation. FINITE supports multi-level user-defined substructuring and condensation for linear and nonlinear analysis. Isolation of the element and material model libraries from the system enables rapid entry of new modeling capabilities. GRA

N79-20775# Yale Univ., New Haven, Conn.

INTERESTINGNESS: CONTROLLING INFERENCES

Roger C. Schank Oct. 1978 50 p refs
(Contract N00014-75-C-1111)
(AD-A062840; RR-145) Avail: NTIS HC A03/MF A01 CSCL 05/7

The problem of controlling inference is one of the most serious in Artificial Intelligence. New types of goal and plan inferences seriously compound the problem. This paper attempts to outline one possible solution to controlling inferences, namely following what is interesting and ignoring what is not. Author (GRA)

N79-20776# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

COMPARATIVE SCHEMATOLOGY

Carl E. Hewitt and Michael S. Patterson May 1978 12 p
(Contract N00014-75-C-0643; N00014-75-C-0522)
(AD-A062699; AI-M-464) Avail: NTIS HC A02/MF A01 CSCL 09/2

While we may have the intuitive idea of one programming language having greater power than another, or of some subset of a language being an adequate 'core' for that language, we find when we try to formalize this notion that there is a serious theoretical difficulty. This lies in the fact that even quite rudimentary languages are nevertheless 'universal' in the following sense. If the language allows us to program with simple arithemtic or list-processing functions than any effective control structure can be simulated, traditionally, by encoding a Turing machine computation in some way. In particular, a simple language with some basic arithmetic can express programs for any partial recursive function. Such an encoding is usually quite unnatural and impossibly inefficient. Thus, in order to carry on a practical study of the comparative power of different languages we are led to banish explicit functions and deal instead with abstract, uniterpreted programs, or schemas. What follows is a brief report on some preliminary exploration in this area. Author (GRA)

N79-20777# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

TARTAN LANGUAGE DESIGN FOR THE IRONMAN REQUIREMENT NOTES AND EXAMPLES

Mary Shaw, Paul Hilfinger, and Wm. A. Wurf Jun. 1978 20 p

refs
(Contract F44620-73-C-0074)
(AD-A062815; CMU-78-132) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Tartan language was designed as an experiment to see whether the Ironman requirement for a common high-order programming language could be satisfied by an extremely simple language. The result, Tartan substantially meets the Ironman requirement. We believe it is substantially simpler than the four designs that were done in the first phase of the DOD-1 effort. The language definition appears in a companion report; this report provides a more expository discussion of some of the language's features, some examples of its use, and a discussion of some facilities that could enhance the basic design at relatively little cost. Author (GRA)

N79-20778# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

DETERMINING SHAPE AND REFLECTANCE USING MULTIPLE IMAGES

Berthold K. P. Horn, Robert J. Woodham, and William M. Silver Aug. 1978 10 p refs
(Contract N00014-77-C-0389)
(AD-A062380; AI-M-490) Avail: NTIS HC A02/MF A01 CSCL 14/2

Distribution of surface orientation and reflectance factor on the surface of an object can be determined from scene radiances observed by a fixed sensor under varying lighting conditions. Such techniques have potential application to the automatic inspection of industrial parts, the determination of the attitude of a rigid body in space and the analysis of images returned from planetary explorers. A comparison is made of this method with techniques based on images obtained from different viewpoints with fixed lighting. Author (GRA)

N79-20779# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.

SPACE-TIME TRADEOFFS IN STRUCTURED PROGRAMMING: AN IMPROVED COMBINATORIAL EMBEDDING THEOREM

Richard A. DeMillo, Stanley C. Eisenstat, and Richard J. Lipton Aug. 1978 14 p refs Prepared in cooperation with Yale Univ., New Haven, Conn.
(Contract N00014-67-A-0097-0016; Grants DAHC04-74-G-0179; DAAG29-76-C-0338; NSF DCR-74-12870)
(AD-A062495; GIT-ICS-78/03) Avail: NTIS HC A02/MF A01 CSCL 12/1

An improvement for a space-time inequality of a 'goto' program by an exponential is discussed. The combinational theorem presented describes such an improvement. Let G and G^* be programs represented by direct graphs. A relation is defined of less than or equal to S,T between G and G^* that formalizes the notion of G^* simulating G with S-fold loss of space efficiency and T-fold loss of time efficiency, and prove that if G is equal to or less than S,T, G^* where G has n statements and G^* is structured, then in the worst case T + log to the base 2 x log to the base 2 of S is less than or equal to log to the base 2 of n + 0 (log to the base 2 x log to the base 2 of n). The programming language significance of the graphs and relations are discussed. M.M.M.

N79-20780# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.

A FEASIBLE DIRECTION SUBGRADIENT ALGORITHM FOR A CLASS OF NONDIFFERENTIABLE OPTIMIZATION PROBLEMS

Jacques Chatelon, Donald Hearn, and Timothy J. Lowe Oct. 1978 25 p refs
(Grants DAHC04-75-G-0150; NSF ENG-76-17810)
(AD-A062089; RR-78-13; ARO-12640.35-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

An implementable feasible direction subgradient algorithm is presented for minimizing the maximum of a finite collection of functions subject to constraints. It is assumed that each function involved in defining the objective function is the sum of a finite collection of basic convex functions and that the number of different subgradient sets associated with nondifferentiable points of each basic function is finite on any bounded set. It is demonstrated that under certain conditions, including continuous differentiability of the constraints and a regularity condition of the feasible region, that the algorithm generates a feasible sequence which converges to an E-optimal solution. The results of some computational experiments are included. GRA

N79-20781# Harvard Univ., Cambridge, Mass. Center for Research in Computing Technology.

ABSTRACT MODEL OF MSG FIRST PHASE OF AN EXPERIMENT IN SOFTWARE DEVELOPMENT Final Report

Glenn H. Holloway, William R. Bush, and George H. Mealy Oct. 1978 180 p refs
(Grant N00039-78-G-0020; ARPA Order 3079)
(AD-A062124) Avail: NTIS HC A09/MF A01 CSCL 09/2

This report describes the first phase of an experiment designed to demonstrate techniques for software development and evolution. The experiment involves the production of a family of functionally similar systems on dissimilar host computers with markedly different operating systems. The basic technique being used is machine assisted stepwise refinement from an abstract model program that embodies the desired characteristics of the family members without overconstraining the individual implementations. The example system being developed in this experiment is MSG, the interprocess communication component of the National Software Works (NSW). MSG has already been specified and implemented by conventional means for several host computers. Our experiment consists of: production of an abstract model of the MSG family, realization of MSG on two actual hosts, to study the incremental costs of producing new instances by our techniques from a suitable model, and evolution of the MSG family in accord with actual changes to the MSG specification as they arise, to evaluate the efficiencies of maintaining families in unison. Author (GRA)

N79-20782# Naval Postgraduate School, Monterey, Calif.

AN INTERACTIVE SOFTWARE PACKAGE FOR TIME SERIES ANALYSIS M.S. Thesis

Stephen Russell Woodall Sep. 1978 243 p refs
(AD-A062168) Avail: NTIS HC A11/MF A01 CSCL 09/2

An expanded package of interactive FORTRAN computer programs has been developed for the analysis and forecasting of time series data. The package, called the Time Series Editor, is designed to employ the iterative Box-Jenkins methodology of time series analysis. The Time Series Editor was developed for time-shared use on the Control Program/Cambridge Monitor System (CP/CMS) at the U.S. Naval Postgraduate School, but can be modified for use on other time-sharing systems with a FORTRAN capability. The Time Series Editor assists in data preparation and entry, analysis, modeling, forecating and diagnostic testing. Utilization of the package, following the included User's Guide, requires only a limited knowledge of the computer system, with all required user responses interactively prompted by the Editor. Author (GRA)

N79-20783# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.

THE EDUCATIONAL EFFECTIVENESS OF GRAPHIC DISPLAY FOR COMPUTER ASSISTED INSTRUCTION Final Report

M. V. Moore and L. H. Naurocki Sep. 1978 60 p refs
(AD-A062585; ARI-TP-332) Avail: NTIS HC A04/MF A01 CSCL 05/9

This report reviews the literature on instructional graphics and implications of the findings in terms of graphic displays for computer-assisted instruction. It was concluded that (1) assumptions about the inherent value of graphics for instructional purposes are unsubstantiated by empirical evidence, and (2) the conditions under which the use of graphics may increase instructional effectiveness remain to be determined. Comparisons between alphanumeric and graphic displays, and between different graphic representations, suggest that future research should systematically explore the use of graphics as a function of task requirements, subject-matter content, and learner characteristics. The research also suggests that (1) the interpretation of research outcomes is contingent upon the dependent measures obtained,

and (2) particular attention should be given to measures of delayed retention. Author (GRA)

N79-20784# California Univ., Berkeley. Operations Research Center.
SCHEDULING TASKS WITH EXPONENTIAL SERVICE TIMES ON NONIDENTICAL PROCESSORS TO MINIMIZE VARIOUS COST FUNCTIONS
Gideon Weiss and Michael Pinedo Aug. 1978 34 p refs
(Contract N00014-77-C-0299; Grant AF-AFOSR-3213-77)
(AD-A062471; ORC-78-16) Avail: NTIS HC A03/MF A01 CSCL 09/2

We consider preemptive scheduling of N tasks on m processors; processors have different speeds, tasks require amounts of work which are exponentially distributed, with different parameters. The policies of assigning at every moment the task with shortest (longest) expected processing time among those not yet completed to the fastest processor available, 2nd shortest (longest) to the 2nd fastest etc., are examined, and shown to minimize expected values of various cost functions. As special cases we obtain policies which minimize expected flowtime, expected makespan and expected lifetime of a series system with m component locations and N spares. Author (GRA)

N79-20785# Yale Univ., New Haven, Conn. Dept. of Computer Science.
UNDERSTANDING GOAL-BASED STORIES Ph.D. Thesis
Robert Wilensky Sep. 1978 330 p refs
(Contract N00014-75-C-1111)
(AD-A062629; RR-140) Avail: NTIS HC A15/MF A01 CSCL 05/7

Reading requires reasoning. A reader often needs to infer connections between the sentences of a text and must therefore be capable of reasoning about the situations to which the text refers. People can reason about situations because they possess a vast store of knowledge which they can use to infer implicit parts of a situation from those aspects of the situation explicitly described by a text. PAM (Plan Applier Mechanism) is a computer program that understands stories by reasoning about the situations they reference. PAM reads stories in English and produces representations for the stories that include the inferences needed to connect each story's events. To demonstrate that it has understood a story, PAM answers questions about the story and expresses the story from several points of view. PAM reasons about the motives of a story's characters. Many inferences needed for story understanding are concerned with finding explanations for events in the story. PAM has a great deal of knowledge about people's goals which it applies to find explanations for the actions taken by a story's characters in terms of that character's goals and plans. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N79-20786 California Univ., Los Angeles.
ON THE LARGE-CHANGE SENSITIVITIES OF DIGITAL NETWORKS AND THE DEVELOPMENT OF NEW FFT ALGORITHMS Ph.D. Thesis
Kwang Myung Cho 1978 149 p
Avail: Univ. Microfilms Order No. 7906160

Digital filtering and the fast Fourier transorm (FFT) in digital signal processing are discussed. Some computational aspects are presented with the formula derived. The FFT and related algorithms were investigated and used to develop new algorithms. Results indicate that the algebraic derivation makes the identification of the multiplier factors and unscrambling of the scrambled data easier. Dissert. Abstr.

N79-20787*# Vought Corp., Hampton, Va. Technical Center.
VORTAB - A DATA-TABLET METHOD OF DEVELOPING INPUT DATA FOR THE VORLAX PROGRAM
Frederick M. Denn Mar. 1979 82 p refs
(Contract NAS1-13500)
(NASA-CR-159026) Avail: NTIS HC A05/MF A01 CSCL 09B

A method of developing an input data file for use in the aerodynamic analysis of a complete airplane with the VORLAX computer program is described. The hardware consists of an interactive graphics terminal equipped with a graphics tablet. Software includes graphics routines from the Tektronix PLOT 10 package as well as the VORTAB program described. The user determines the size and location of each of the major panels for the aircraft before using the program. Data is entered both from the terminal keyboard and the graphics tablet. The size of the resulting data file is dependent on the complexity of the model and can vary from ten to several hundred card images. After the data are entered, two programs READB and PLOTB, are executed which plot the configuration allowing visual inspection of the model. L.P.

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N79-20788 Carnegie-Mellon Univ., Pittsburgh, Pa.
ADVANCED APPROACHES IN OPTICAL PATTERN RECOGNITION TECHNIQUES FOR AREA CORRELATION Ph.D. Thesis
Alan Theodore Furman 1978 142 p
Avail: Univ. Microfilms Order No. 7904880

The basic theory of the frequency plane correlator is presented. The signal-to-noise ratio (SNR) and peak intensity of the correlation output are used as measures of optimum correlation and a diffraction pattern sampling unit is used to ensure reliable and reproducible data. A correlator is described that combines optical and electronic processing. The optical section is the first Fourier transform taking stage of a joint transform correlator; its output is electronically processed by a modified spectrum analyzer. Increased flexibility and various processing operations beyond those normally possible in an optical system result. The equalizing and coherence measure correlators are described. Dissert. Abstr.

N79-20789 Brown Univ., Providence, R. I.
ADAPTIVE CONTROL AND IDENTIFICATION OF LINEAR SYSTEMS Ph.D. Thesis
Howard Elliott 1978 164 p
Avail: Univ. Microfilms Order No. 7906543

Parameter adaptive control systems can be divided into two categories. Controllers in the first category adapt their parameters to minimize a measurable performance index. Those in the second category explicitly identify a parametrized model of the unknown plant and functionally relate the controller parameters to those of the model. New design techniques are introduced for continuous time linear systems which fall into both categories.
Dissert. Abstr.

N79-20790*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPROXIMATE MAXIMUM LIKELIHOOD DECODING OF BLOCK CODES
H. J. Greenberger Feb. 1979 65 p refs
(Contract NAS7-100)
(NASA-CR-158419; JPL-Pub-78-107) Avail: NTIS HC A04/MF A01 CSCL 09B

Approximate maximum likelihood decoding algorithms, based upon selecting a small set of candidate code words with the aid of the estimated probability of error of each received symbol, can give performance close to optimum with a reasonable amount of computation. By combining the best features of various algorithms and taking care to perform each step as efficiently as possible, a decoding scheme was developed which can decode codes which have better performance than those presently in use and yet not require an unreasonable amount of computation. The discussion of the details and tradeoffs of presently known efficient optimum and near optimum decoding algorithms leads, naturally, to the one which embodies the best features of all of them. L.S.

N79-20791# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

UNDERSTANDING IN INCOMPLETE WORLDS
Steven Rosenberg May 1978 29 p refs
(Contract N00014-75-C-0643)
(AD-A062364; AI-M-475) Avail: NTIS HC A03/MF A01 CSCL 05/1

Most real world domains differ from the micro-worlds traditionally used in A.I. in that they have an incomplete factual database which changes over time. Understanding in these domains can be thought of as the generation of plausible inferences which are able to use the facts available, and respond to changes in them. A traditional rule interpreter such as Planner can be extended to construct plausible inferences in these domains by (1) allowing assumptions to be made in applying rules, resulting in simplifications of rules which can be used in an incomplete database; (2) monitoring the antecedents and consequents of a rule so that inferences can be maintained over a changing database. The resulting chains of inference can provide a dynamic description of an event. This allows general reasoning processes to be used to understand in domains for which large numbers of Schema-like templates have been proposed as the best model. Author (GRA)

N79-20792# Pattern Analysis and Recognition Corp., Rome, N. Y.
MULTICS LONG WAVEFORM ANALYSIS SYSTEM Final Technical Report
Thomas L. McGibbon Griffiss AFB, N. Y. RADC Oct. 1978 552 p refs
(Contract F30602-77-C-0090)
(AD-A062111; PAR-78-28; RADC-TR-78-218) Avail: NTIS HC A24/MF A01 CSCL 09/2

The objective of the research described in this report was the development and software implementation of a Long Waveform Analysis System (WAVES) on the Honeywell 6180 Computer System running under the MULTICS Operating System. The currently operational WAVES System is an open-ended and flexible system for primary use in feature definition and extraction and, as such, serves as a front-end to the MULTICS version of OLPARS (On-Line Pattern Analysis and Recognition System). The development of computer-based interactive feature definition and pattern classification systems has been a continuing program at Rome Air Development Center since 1968. This long standing effort has resulted in the implementation of OLPARS, IFES (the Image Feature Extraction System), IDRS (the Interactive Digital Receiver Simulator System), and WPS (the Waveform Processing System). WAVES represents a furtherance of this continuing effort and a logical expansion and improvement of currently available waveform analysis and feature definition systems. Author (GRA)

N79-20793# Naval Postgraduate School, Monterey, Calif.
A SIMULATION STUDY OF A CLASS OF FIRST-COME FIRST-SERVED QUEUES WITH EARMA CORRELATION STRUCTURE M.S. Thesis
Prasert Boonsong Sep. 1978 140 p refs
(AD-A062165) Avail: NTIS HC A07/MF A01 CSCL 12/1

The object of this thesis is to examine, via simulation, the properties of a class of single-server, first-come first-served queues in which the service times and interarrival times, while still marginally exponential, are auto-correlated and cross-correlated. The correlation is introduced by letting the service and interarrival sequences by EARMA-type processes, where EARMA stands for exponential autoregressive, moving average sequence. An extension of these ideas brings in the cross-correlation. The waiting times in the dependent queue are compared to the waiting times (with known distribution) in the independent M/M/1 queue using data analytic and formal statistical methods. Variance reduction techniques are also studied; these use distributionally known aspects of the M/M/1 queue (simulated with the same exponential sequences as the dependent queue) to control the unknown aspects of the dependent queue. Author (GRA)

N79-20794# Army Military Personnel Center, Alexandria, Va.
A NUMERICAL METHOD FOR SHAPE-FROM-SHADING FROM A SINGLE IMAGE M.S. Thesis Final Report
Thomas M. Strat 19 Jan. 1979 113 p refs
(AD-A063071) Avail: NTIS HC A06/MF A01 CSCL 05/8

The shape of an object can be determined from the shading in a single image by solving a first-order, non-linear partial differential equation. The method of characteristics can be used to do this, but it suffers from a number of theoretical difficulties and implementation problems. This thesis presents an iterative relaxation algorithm for solving this equation on a grid of points. Here, repeated local computations eventually lead to a global solution. The algorithm solves for the surface orientation at each point by employing an iterative relaxation scheme. The constraint of surface smoothness is achieved while simultaneously satisfying the constraints imposed by the equation of image illumination. The algorithm has the distinct advantage of being capable of handling any reflectance function whether analytically or empirically specified. Included are brief overviews of some of the more important shape-from-shading algorithms in existence and a list of potential applications of this iterative approach to several image domains including scanning electron microscopy, remote sensing of topography and industrial inspection. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N79-20795*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ALTERNATING DIRECTION IMPLICIT METHODS FOR PARABOLIC EQUATIONS WITH A MIXED DERIVATIVE
Richard M. Beam and R. F. Warming Mar. 1979 58 p refs
(NASA-TM-78569; A-7766) Avail: NTIS HC A04/MF A01 CSCL 12A

Alternating direction implicit (ADI) schemes for two-dimensional parabolic equations with a mixed derivative are constructed by using the class of all A sub 0-stable linear two-step methods in conjunction with the method of approximation factorization. The mixed derivative is treated with an explicit two-step method which is compatible with an implicit A sub 0-stable method. The parameter space for which the resulting ADI schemes are second order accurate and unconditionally stable is determined. Some numerical examples are given. Author

N79-20796# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Computer Science.
EQUIVALENT FORMS OF MULTISTEP FORMULAS Interim Report
Robert D. Skeel Aug. 1978 43 p refs
(Grant AF-AFOSR-2854-75)
(AD-A062737; AFOSR-78-1545TR; UILU-ENG-78-1730) Avail: NTIS HC A03/MF A01 CSCL 12/1

For uniform meshes it is shown that any linear k-step formula can be formulated so that only k values need to be saved between steps. By saving an additional m values it is possible to construct local polynomial approximations of degree k-m-1, which can be used as predictor formulas. Different polynomial bases lead to different equivalent forms of multistep formulas. In particular, local monomial bases yield Nordsieck formulas. An explicit one-to-one correspondence is established between Nordsieck formulas and k-step-formulas of order at least k, and a strong equivalence result is proved for all but certain pathological cases. Equivalence is also shown for $P(EC)^*$ formulas but not for $P(EC)^*E$ formulas. Author (GRA)

N79-20797# Naval Postgraduate School, Monterey, Calif.
DISCRETE TIME SERIES GENERATED BY MIXTURES. 3: AUTOREGRESSIVE PROCESSES (DAR(p))
P. A. Jacobs and P. A. W. Lewis Sep. 1978 49 p refs Sponsored in part by ONR
(Contract NSF 77-09020; Grant NSF AF-476)
(AD-A062208; NPS55-78-022) Avail: NTIS HC A03/MF A01 CSCL 12/1

A scheme for obtaining a stationary sequence of discrete random variables which has p-th order Markov dependence and a specified marginal distribution is presented. This DAR(p) process, which is a particular p-th order Markov chain, has the physical and correlation structure of an autoregressive process of order p. The process and its transition matrix are determined by the

specified marginal distribution and by several other parameters which, independently of the marginal distribution, determine the correlation structure. Correlational properties and initial conditions for stationarity of the process are studied. Asymptotic properties for the process are also obtained. Author (GRA)

N79-20798# California Univ., Los Angeles. School of Engineering and Applied Science.

COMBINING DATA FOR IMPROVED WEIBULL PARAMETER ESTIMATION Technical Report, 1978-1979

S. B. Batdorf and George Sines Sep. 1978 30 p refs

(Contract N00014-76-C-0445)

(AD-A062613; UCLA-ENG-7840) Avail: NTIS HC A03/MF A01 CSCL 12/1

Weibull parameters are often used by experimentalists to characterize the fracture behavior of structural materials. Frequently several different types of tests are performed, and theory indicates that the parameters for each type should be the same, or have some specific relations to each other. In such cases, it is advantageous to combine the data to find the parameters best representing all the data. The present paper discusses techniques for carrying out this objective and analyzes two examples in detail to illustrate the principles involved. The first example compares uniaxial and equibiaxial fracture statistics. The second example discusses fracture statistics for single fibers of several different lengths. Author (GRA)

N79-20799# Stanford Univ., Calif. Systems Optimization Lab.

FORTRAN SUBROUTINES TO SOLVE THE LINEAR LEAST-SQUARES PROBLEM AND COMPUTE THE COMPLETE OTHOGONAL FACTORIZATION

Margaret H. Wright and Steven C. Glassman Apr. 1978 141 p refs

(Contracts N00014-75-C-0267; EY-76-S-03-0326; Grants NSF MCS-76-20019; NSF ENG-77-06761)

(AD-A062376; SU-SOL-78-8) Avail: NTIS HC A07/MF A01 CSCL 12/1

This report describes the computational procedures involved in: solution of linear least-squares problems (including systems of non-singular, over- and under-determined linear equations); formation of the complete orthogonal factorization of a general real matrix. Some aspects of implementation and the estimation of rank are discussed. Full documentation (including source code) is given for a modular set of Fortran subroutines to solve these problems and several related problems. Author (GRA)

N79-20800# Maryland Univ. Baltimore County, Baltimore. Div. of Mathematics and Physics.

OPTIMAL FILTERS FOR BILINEAR SYSTEMS WITH NILPOTENT LIE ALGEBRAS

Shirish D. Chikte and James Ting-HoLo Oct. 1978 33 p refs (Grant AF-AFOSR-2671-74)

(AD-A062094; MRR-78-13; AFOSR-78-1505TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

We consider a bilinear signal process driven by a Gauss-Markov process which is observed in additive, white, Gaussian noise. An exact stochastic differential equation for the least squares filter is derived when the Lit algebra associated with the signal process is nilpotent. It is shown that the filter is also bilinear and moreover that it satisfies an analogous nilpotency condition. Finally, some special cases and an example are discussed, indicating ways of reducing the filter dimensionality. Author (GRA)

N79-20801# George Washington Univ., Washington, D. C.

USE OF A STABLE GENERALIZED INVERSE ALGORITHM TO EVALUATE NEWTON METHOD STRATEGIES Program in Logistics

Gholamreza Emami and Garth P. McCormick 25 Oct. 1978 63 p refs

(Contract N00014-75-C-0729; NR Proj. 347-020)

(AD-A062098; SERIAL-T-384) Avail: NTIS HC A04/MF A01 CSCL 12/1

Modifications of Newton's method for minimizing an unconstrained function are presented. A numerically stable matrix factorization is given for obtaining the generalized inverse of an approximation to the positive part of the Hessian matrix and directions of nonpositive curvature. Three different modified Newton strategies are interfaced with the computer program SUMT which transforms a constrained minimization problem into a sequence of unconstrained problems. Numerical evaluation of these three strategies is given for a variety of test problems. Author (GRA)

N79-20802# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.

ON SMALL UNIVERSAL DATA STRUCTURES AND RELATED COMBINATORIAL PROBLEMS

Richard A. DeMillo, Stanley C. Eisenstat (Yale Univ.), and Richard J. Lipton (Yale Univ.) Aug. 1978 14 p refs Sponsored in part by the Mathematics Research Center, Wisconsin Univ.-Madison

(Grant DAAG29-76-G-0338)

(AD-A062494; GIT-ICS-78/05; ARO-14690.5-EL) Avail: NTIS HC A02/MF A01 CSCL 12/1

A universal graph for a class of graphs T is a graph G such that every graph in T can be embedded in G with worst-case (average case) loss of proximity bounded by a fixed constant. A universal graph can be interpreted as a universal data structure. Upper and lower bounds are derived for a variety of restrictions on T and G. Author (GRA)

N79-20803# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.

WALSH-FUNCTION REPRESENTATION OF SHIFT REGISTERS WITH STOCHASTIC INPUTS

A. Udaya Shankar and David K. Cheng Oct. 1978 12 p refs (Grant AF-AFOSR-2809-75)

(AD-A062537; TR-78-9; AFOSR-78-1631TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

A Walsh-Hadamard description for the operation of linear-feedback shift registers is presented. It is used to study the transient and steady-state behavior at the outputs of shift registers with respect to a stochastic input and an initial register state. Author (GRA)

N79-20804# Ohio State Univ., Columbus. Dept. of Statistics.

APPROXIMATE MAXIMUM LIKELIHOOD ESTIMATES IN REGRESSION MODELS FOR GROUPED DATA

A. Indrayan and J. S. Rustagi 1978 23 p refs

(Contract N00014-78-C-0543)

(AD-A062926; TR-165) Avail: NTIS HC A02/MF A01 CSCL 12/1

Grouped data arise quite frequently in application. Various experimental situations naturally lead to observations classified into certain groups. The process of recording or storing observations directly leads to grouped data. Other examples of circumstances which lead to grouped data have recently been discussed by Haitovsky (1973) in his monograph on regression estimation from grouped data has been advocated by Durbin (1954) as a technique for minimizing errors of measurement. Grouped observations also result in experiments where precise measuring instruments are not available. GRA

N79-20805# Ecodynamics Research Associates, Inc., Albuquerque, N. Mex.

A SIXTH-ORDER ACCURATE DIRECT SOLVER FOR THE POISSON AND HELMHOLTZ EQUATIONS

Patrick J. Roache Oct. 1978 20 p refs

(Contract N00014-76-C-0636; NR Proj. 061-224)

(AD-A062952) Avail: NTIS HC A02/MF A01 CSCL 12/1

An O9h6 accurate direct solver is described for a class of separable elliptic equations in (r,0) coordinates with periodic conditions in 0. A discrete Fourier transform is used in 0, and the Hermite 6 discretization of Rubin and Khosla is used in r. A single deferred correction at boundary points gives the O(h6) accuracy, in O(N21nN) operations for an NxN problem. Author (GRA)

N79-20806# Delaware Univ., Newark. Inst. for Mathematical Sciences.

OPERATOR VALUED FUNCTIONS AND BOUNDARY VALUE PROBLEMS FOR THE HELMHOLTZ-EQUATION. 1. SPHERICAL GEOMETRIES Interim Report

R. E. Kleinman and G. F. Roach Jul. 1978 59 p refs Prepared

in cooperation with Strathclyde Univ., Glassgow, Scotland
(Grant AF-AFOSR-2634-74)
(AD-A062685; IMS-TR-40) Avail: NTIS HC A04/MF A01 CSCL 12/1

The boundary integral operator which arises in a double layer formulation of the Neumann problem for the Helmholtz equation is analyzed as an operator valued function of wave number in the particular case of a spherical boundary. The spectrum of the operator is found and its explicit dependence on wave number is exhibited, both analytically and numerically. In addition, the explicit solar decomposition of the operator is carried out and it is shown that asymptotically the operator becomes self adjoint for small values of wave numbers and unitary for large values. Advantages of operator factorization are discussed. Author (GRA)

N79-20807# ARO, Inc., Arnold Air Force Station, Tenn.
APPLICATION OF SPLINES TO THE NUMERICAL SOLUTION OF TWO-POINT BOUNDARY-VALUE PROBLEMS Final Report, Oct. 1977 - Aug. 1978
Donald C. Todd and John C. Adams, Jr. AEDC Dec. 1978 124 p refs
(AD-A062682; AEDC-TR-78-59) Avail: NTIS HC A06/MF A01 CSCL 12/1

In the search for better methods to solve the Navier-Stokes equations, this is a preliminary test of spline collocation, or the application of spline collocation to solve two-point boundary-value problems. Pertinent spline theory and the spline collocation method are developed from first principles. The problems considered are nonlinear, third-order, ordinary differential equations. A FORTRAN IV computer program to solve such problems is described, and a source deck listing is included. Several sample problems solved by the program are presented.
Author (GRA)

N79-20808# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.
THE NUMERICAL SOLUTION OF SINGULAR SINGULARLY-PERTURBED INITIAL VALUE PROBLEMS Interim Report
J. E. Flaherty and R. E. OMalley, Jr. Nov. 1978 32 p refs
Prepared in cooperation with Arizona Univ., Tucson
(Grant AF-AFOSR-2818-75; AF Proj. 2304)
(AD-A062734; AFOSR-78-1580TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

We consider the vector initial value problem epsilou y-dot = f(y,t,epsilou), y(0) = y superscript 0 (epsilou) in the situation when the m x m matrix fy(y,t,0) is singular with constant rank k - m and has k stable eigenvalues. We show how to determine the unique limiting solution Y sub 0 of the reduced problem f(Y sub 0, t,0) = 0 and how to obtain a uniform asymptotic expansion of the solution which is valid for small values of epsilou on finite t intervals. A numerical technique is developed to calculate the limiting solution and the results of some examples are compared with an existing code for stiff differential equations. Author (GRA)

N79-20809*# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
APPLICATIONS OF ALGEBRAIC GEOMETRY IN SYSTEM THEORY Interim Report
Peter L. Falb (Harvard Univ., Cambridge, Mass.) and Christopher I. Byrnes Oct. 1978 43 p refs
(Grant NsG-2265; Contract N00014-75-C-0648; Grant AF-AFOSR-1516-78)
(NASA-CR-158408; AD-A062770; AFOSR-78-1516TR) Avail: NTIS HC A03/MF A01 CSCL 12A

System theory is concerned with the modelling and analysis of phenomena both natural and man-made. It is a discipline whose formal beginnings go back at least to Watt and Maxwell and much of its motivation stems from engineering problems. Before World War II, a system design and analysis were primarily an art. During and after the war, techniques based on complex variable theory were developed and applied primarily to single input, single output systems represented by a rational function, called the transfer function. The theory of servomechanisms developed rapidly from the end of the war to the early fifties and time-domain methods were applied. The representation of transfer functions via linear, constant-coefficient, differential equations led to a renewed interest in so-called state space methods. The rapid development of the theory followed and continues today. However, the increasing complexity of the engineering and economic problems considered required greater mathematical sophistication. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N79-20810 Stanford Univ., Calif.
MIXING CONDITIONS AND LIMIT THEOREMS FOR MAXIMA OF SOME STATIONARY SEQUENCES Ph.D. Thesis
Michael Ross Chernick 1978 97 p
Avail: Univ. Microfilms Order No. 7905831

Limit theorems for maxima of strictly stationary stochastic sequences are obtained for a few examples. These include an exponential first order autoregressive process, a class of uniform first order autoregressive processes, and an exponential autoregressive-moving average process. Sufficient conditions for strong mixing and for D(u sub n) to hold are obtained for autoregressive and Markov sequences. A first order autoregressive Cauchy sequence is shown to satisfy the strong mixing condition.
Dissert. Abstr.

N79-20811 Maryland Univ., College Park.
SHRINKAGE IN RIDGE REGRESSION AND ORDINARY LEAST SQUARES MULTIPLE REGRESSION ESTIMATORS Ph.D. Thesis
Vivian Betty Faden 1978 83 p
Avail: Univ. Microfilms Order No. 7906669

The relative efficacies of ridge regression and ordinary least squares regression was studied by the Monte Carlo method. For each experimental condition in the five factor experiment, multivariate normal data with a given covariance matrix were generated.

N79-20812 Kansas State Univ., Manhattan.
ON SOME ROBUST PROCEDURES IN THE ANALYSIS OF LINEAR MODELS Ph.D. Thesis
Ann Inez Nolasco Gironella 1978 98 p
Avail: Univ. Microfilms Order No. 7906772

In the problem of estimating the parameters of a linear model, the least squares theory provides estimates which possess optimal properties when the errors are normally distributed. However, in many practical situations, the presence of outliers is suspected or the distribution of the errors may have heavier tails than normal. In these cases, the least squares procedure may not provide good estimators. To reduce the effect of outlying data points in the estimation of the parameters in the simple linear regression model, Winsorization techniques are applied to Studentized residuals. It is found that estimators based on Winsorized Studentized residuals maintain high efficiencies over least squares estimators when the data are taken from scale contaminated normals; but when the data are not contaminated, a loss in efficiency is observed. Dissert. Abstr.

N79-20813 Purdue Univ., Lafayette, Ind.
KINETICS OF ORDER-DISORDER TRANSFORMATIONS Ph.D. Thesis
Klaus Gschwend 1978 176 p
Avail: Univ. Microfilms Order No. 7905725

A general theory for non-linear phenomena in non-equilibrium systems based on the Path Probability method of non-equilibrium statistical mechanics, is presented and discussed utilizing specifically the order-disorder transition in a binary alloy of body centered cubic structure. In order to deal with kinetics, a realistic model of atomic exchange by means of a vacancy mechanism is assumed. The kinetic processes calculated by the Path Probability method, lead to an equilibrium state in the long time as specified by the corresponding approximation of the Cluster Variation method which is well-understood in nature within the equilibrium theory of order-disorder transformations. The pair approximation was adopted. The theory is applied first in a

linearized form to relaxation phenomena near equilibrium. Characteristic relaxation times are derived for isothermal approach to equilibrium and their meanings in relaxation processes are discussed. Dissert. Abstr.

N79-20814 Stanford Univ., Calif.
ASYMPTOTIC DISTRIBUTION THEORY IN GENERALIZED ISOTONIC REGRESSION Ph.D. Thesis
Sue Ellen Leurgans 1978 172 p
Avail: Univ. Microfilms Order No. 7905896

Isotonic regression can be used to estimate an underlying monotone function. The most common estimator, the isotonized mean, is closely related to the arithmetic mean, which was shown to lack robustness in many situations. The asymptotic efficiency of an approach to isotonic regression is explored based on linear combinations of order statistics. Dissert. Abstr.

N79-20815 Pittsburgh Univ., Pa.
A C'-CONFORMING CURVED PLATE BENDING ELEMENT WHICH SATISFIES THE CONSTANT STRAIN CONDITION Ph.D. Thesis
Addison Eugene Frey 1978 138 p
Avail: Univ. Mcrofilms Order No. 7902751

If the element domains have curved boundaries, then the entries of the element stiffness matrices are integrals of rational functions. It is shown that, even though numerical integration of these entries may introduce sizeable errors in their computation, the validity of the constant strain condition for second order elliptic differential equations need not be destroyed. Numerical integration of these entries does, however, destroy the validity of the constant strain condition for problems governed by fourth order elliptic equations. A typical problem governed by a fourth order elliptic differential equation is the classical plate bending problem. An element conforming with plate bending problems is constructed which has curved boundaries and which satisfies the constant strain condition. The high rate of convergence of the new element is demonstrated both theoretically and experimentally. Dissert. Abstr.

N79-20816 California Univ., Berkeley.
ON ESTIMATING A COMMON MEAN Ph.D. Thesis
Joel Barry Brodsky 1978 92 p
Avail: Univ. Microfilms Order No. 7904388

The problem of estimating a common population mean is considered by examining the behavior of a weighted combination of the sample means, where the weights depend on the reciprocals of variance estimates. For both the 2-sample and the p-sample problems, expansions for both the expectation and the variance of the weighted mean are obtained. In the 2-sample case under the assumption of Normality, an exact sample size bound for the variance of the weighted mean, when the weights are functions of the usual sample variances, is obtained and partially based upon this bound a comparison between the sample-variance weighted mean, mu sub S, and the grand mean is made. The results of the comparison are highly favorable to mu sub S. In the summetric 2-sample problem, comparisons between mu sub S and the MINQUE weighted mean and between mu sub S and the grand mean are also made. Both comparisons were favorable in most situations to mu sub S. Dissert. Abstr.

N79-20817# Florida State Univ., Tallahassee. Dept. of Statistics.
LARGE SAMPLE ESTIMATES AND UNIFORM CONFIDENCE BOUNDS FOR THE FAILURE RATE FUNCTION BASED ON A NAIVE ESTIMATOR
J. Sethuraman and Nozer D. Singpurwalla Aug. 1978 35 p refs
(Contract N00014-77-C-0263; Grant DAAG29-76-G-0238)
(AD-A062314; FSU-Statistics-M472; TR-29-ARO-D; ARO-13888.14-MX) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper we propose a simple naive estimator of the failure rate function. This estimate is asymptotically unbiased but not consistent. It can be smoothed by using any band limited window. We show that this smoothed estimate is equivalent to estimates obtainable from the modified sample hazard function, as in Rice and Rosenblatt (1976). We obtain the asymptotic distribution of the global deviation of the smoothed estimate from the failure rate function, which can then be used to construct uniform confidence bands. We illustrate the rate of convergence of our estimator by a Monte-Carlo simulation. GRA

N79-20818# Ohio State Univ., Columbus. Dept. of Geodetic Science.
STATISTICAL FOUNDATIONS OF COLLOCATION
Helmut Moritz Jun. 1978 81 p refs
(Contract F19628-76-C-0010)
(AD-A062242; DGS-272; AFGL-TR-78-0182; SR-16) Avail: NTIS HC A05/MF A01 CSCL 12/1

The paper deals with mathematical models suitable as a basis for the statistical treatment of collection. As a preparation, stochastic processes on the circle are discussed first; such processes are simple to understand and exhibit already essential features of the problem. Then the paper treats stochastic processes on the sphere, which may be suitable as statistical models for collocation. Lauritzen's theorem on the nonexistence of ergodic Gaussian stochastic process models for collocation is seen to be essentially dependent on the Gaussian character. Two non-Gaussian ergodic models are given, one of a genuinely probabilistic character similar to Lauritzen's model, and another based on a formal probability theory in rotation group space. This second model gives a statistical foundation of the usual homogeneous and isotropic covariance analysis of the anomalous gravity field; it also provides a basis for the study of the statistical distribution of quantities related to this field. This model allows a formal statistical treatment of the anomalous gravitational field which is independent of an interpretation of this field as some genuinely physical stochastic process and seems, therefore, to be preferable. Author (GRA)

N79-20819# Naval Postgraduate School, Monterey, Calif.
SIMULATION METHODS FOR POISSON PROCESSES IN NONSTATIONARY SYSTEMS
Peter A. Lewis and Gerald S. Shedler Aug. 1978 29 p refs (Grant NSF AF-476)
(AD-A062207; NPS55-78-019) Avail: NTIS HC A03/MF A01 CSCL 12/1

The nonhomogeneous Poisson process is a widely used model for a series of events (stochastic point process) in which the rate or intensity of occurrence of points varies, usually with time. The process has the characteristic properties that the number of points in any finite set of nonoverlapping intervals are mutually independent random varialbes, and that the number of points in any of these intervals has a Poisson distribution. This paper first discusses several general methods for simulation of the one-dimensional nonhomogeneous Poisson process. Then a particular and very efficient method for simulation of nonhomogeneous Poisson processes is stated with log-linear rate function. The method is based on an identity relating the nonhomogeneous Poisson process to the gap statistics from a random number of exponential random variables with suitably chosen parameters. Finally, a simple and relatively efficient new method for simulation of one-dimensional and two-dimensional nonhomogeneous Poisson processes is described. The method is applicable for any given rate function and is based on controlled deletion of points in a Poisson process with a rate function that dominates the given rate function. GRA

N79-20820# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ADAPTIVE ROBUST ESTIMATION OF LOCATION AND SCALE PARAMETERS OF SYMMETRIC POPULATIONS Final Report, Sep. 1977 - Aug. 1978
H. Leon Harter Sep. 1978 111 p refs
(AD-A062436; AFFDL-TR-78-128) Avail: NTIS HC A06/MF A01 CSCL 12/1

Critical values of several criteria, for equal Type 1 and Type 2 error rates (probabilities of misclassification), have now been established for sample sizes n = 8 (4) 24 by means of a Monte Carlo study based on 5000 random samples of each size from each of the above populations Uniform (U), Normal (N), and Double (D). Mean square errors of the adaptive estimates are compared with those of the ML estimates if the population from which each sample came is known, and the effect of debiasing the ML estimates of the standard deviation (sigma) is studied. Adaptive estimation of the canonical scale parameter F sigma,

where the factor F is defined as the multiplier of sigma such that F sigma is the 97.5% point of a population symmetric about zero, is also considered. Monte Carlo studies have also been conducted to determine the performance of the various criteria when applied to an independent set of random samples (obtained by using a different seed for the random number generator) from U, N and D and to random samples from several other symmetric populations, for the above values of n and for the intermediate values n = 10 (4) 22, with critical values of the criteria determined by interpolation. GRA

N79-20821# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mathematics and Statistics.
BAYES AND EQUIVARIANT ESTIMATORS OF THE VARIANCE OF A FINITE POPULATION
S. Zacks and H. Solomon 27 Nov. 1978 23 p refs
(Contract N00014-75-C-0529)
(AD-A062577; TR-35) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem of estimating the variance of a finite population is studied in a Bayesian framework. On the basis of the modern theoretical approach to sampling from finite populations and the special structure of the likelihood functions Bayes estimators of the population variance are derived. The structure of equivariant estimators is analyzed and Bayes equivariant estimators in the strict and the generalized sense are derived. Posterior and prior efficiency of the estimators is discussed. Author (GRA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N79-20822# Massachusetts Univ., Amherst.
HARDWARE ENHANCEMENT OF OPERATING SYSTEMS Final Report, 23 Sep. 1976 - 23 Sep. 1978
Caxton C. Foster 23 Nov. 1978 93 p refs
(Grant DAAG29-76-G-0335)
(AD-A062462; ARO-14230.1-EL) Avail: NTIS HC A05/MF A01 CSCL 12/2

This study investigated what hardware could be added to a conventional computer in order to speed up the execution, decrease the complexity and improve the reliability of an operating system. It was found that content addressable memories would be useful for four aspects of a system: ready queue, clock wake up queue, I/O device control and resource access control. A preliminary design for CAM hardware is included.
Author (GRA)

N79-20823# Naval Postgraduate School, Monterey, Calif.
THE EXPECTED LENGTH OF A MYOPIC INVESTIGATION M.S. Thesis
Peter Carlton Olsen Sep. 1978 35 p refs
(AD-A062166) Avail: NTIS HC A03/MF A01 CSCL 12/2

This thesis addresses the problem of estimating the distance which must be traveled to visit all the targets in a search area. The search area is assumed to be a compact area drawn from an infinite Poisson field. Targets are visited in 'nearest uninvestigated neighbor' order. A simplified analytical model is developed for the unbounded investigation. This model is used to provide heuristic justification for simulation results obtained for the bounded investigation. Author (GRA)

N79-20824# National Bureau of Standards, Washington, D. C.
MATHEMATICAL MODELS FOR SELECTING CATALOGS OF STANDARD-SIZED ITEMS
Douglas R. Shier Sep. 1978 81 p refs
(PB-289803/9; NBSIR-78-1539) Avail: NTIS HC A05/MF A01 CSCL 12B

Various mathematical models for selecting a best catalog of standard sizes are discussed. A survey of existing models for continuous and discrete versions of the catalog selection problem is presented. The advantages and disadvantages of such models are assessed with regard to both range of applicability and computational feasibility. This evaluation shows that a frequently-advocated iterative procedure may produce erroneous results and identifies another approach as the most promising. Various refinements and extensions are proposed for this latter (discrete) model and its associated solution technique (dynamic programming). In particular, a multidimensional version of the catalog selection problem is formulated and analyzed. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N79-20825 Tennessee Univ., Knoxville.
INTRINSIC TOPOLOGIES ON PARTIALLY ORDERED SETS AND RESULTS ON COMPACT SEMIGROUPS Ph.D. Thesis
Ronald Lloyd Wilson 1978 167 p
Avail: Univ. Microfilms Order No. 7903480

The Concepts of a continuous lattice and a generalized continuous lattice are extended to the setting of a partially ordered set. Several notions of convergence are defined for partially ordered sets which generalize the well known idea of the limit infimum of a net in a lattice. The relationships between the topologies induced by these notions of convergence and the ready analogs of the more familiar Scott, Spectra, and Lawson topologies on a lattice are investigated in detail. The ideas of a Lawson poset, a continuous poset and a meet continuous poset are defined, and it is found that the class of continuous posets is precisely the class of meet continuous Lawson posets. Some classes of compact semi-groups, placing primary emphasis on order theoretic properties and techniques through the use of Green's quasiorders. Among other results, it is found an order theoretic condition which will insure that an H trivial semigroup will have at most, one compact Hausdorff semigroup topology. Dissert. Abstr.

N79-20826# California Univ., Los Angeles. Dept. of Mathematics.
ON CERTAIN FINITE DIMENSIONAL NUMERICAL RANGES AND NUMERICAL RADII Interim Report
Moshe Goldberg 1978 23 p refs Presented at NSF Conf. on Linear and Multilinear Algebra, Santa Barbara, Calif., Dec. 1977
(Grant AF-AFOSR-3046-76)
(AD-A062696; AFOSR-78-1635TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This expository solicited paper consists of two parts: The first discusses properties of the classical numerical range and the corresponding numerical radius; the second is devoted to C-ranges and C-radii which are generalizations of the classical concepts. Although the ranges and radii treated here are associated with finite dimensional complex matrices, many of the mentioned results hold for linear operators on arbitrary Hilbert spaces as well. Author (GRA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N79-20827* National Aeronautics and Space Administration. Pasadena Office, Calif.
ACOUSTIC DRIVING OF ROTOR Patent
Hilda Kanber (JPL), Isadore Rudnick (JPL), and Taylor G. Wang.

inventors (to NASA) (JPL) Issued 13 Feb. 1979 4 p Filed 5 Jul. 1977 Supersedes N78-22859 (16 - 13, p 1773) Sponsored by NASA
(NASA-Case-NPO-14005-1; US-Patent-4,139,806; US-Patent-Appl-SN-812447; US-Patent-Class-318-116; US-Patent-Class-60-721; US-Patent-Class-73-505; US-Patent-Class-310-322; US-Patent-Class-310-334; US-Patent-Class-310-20; US-Patent-Class-310-26) Avail: US Patent and Trademark Office CSCL 20A

Sound waves are utilized to apply torque to a body in an enclosure of square cross section, by driving two transducers located on perpendicular walls of an enclosure, at the same frequency but at a predetermined phase difference such as 90 degrees. The torque is a first order effect, so that large and controlled rotational speeds can be obtained.
Official Gazette of the U.S. Patent and Trademark Office

N79-20828 Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INDUSTRIAL NOISE CONTROL MANUAL REVISED EDITION
Paul Jensen, Charles R. Jokel, and Laymon N. Miller Dec. 1978 351 p refs
(Contract DHEW-210-76-0149)
(DHEW/PUB/NIOSH-79/117) Avail: SOD HC

This Manual contains basic information on understanding, measuring, and controlling noise, and more than 60 actual case histories of industrial noise control projects. It is written for persons with little or no experience in noise control. Noise problem analysis, basic methods of noise control, acoustical materials, and the choice of a consultant are discussed. An extensive, partially annotated bibliography of books and articles on relevant topics is included, as is an annotated list of sources containing more case histories. Author

N79-20829*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL STUDY OF COAXIAL NOZZLE EXHAUST NOISE
Jack H. Goodykoontz and James R. Stone 1979 29 p refs Presented at 5th Aeroacoustics Conf., Seattle, Wash., 12-14 Mar. 1979; sponsored by AIAA
(NASA-TM-79090; E-9914) Avail: NTIS HC A03/MF A01 CSCL 20A

Experimental results are presented for static acoustic model tests of various geometrical configurations of coaxial nozzles operating over a range of flow conditions. The geometrical configurations consisted of nozzles with coplanar and non-coplanar exit planes and various exhaust area ratios. Primary and secondary nozzle flows were varied independently over a range of nozzle pressure ratios from 1.4 to 3.0 and gas temperatures from 280 to 1100 K. Acoustic data are presented for the conventional mode of coaxial nozzle operation as well as for the inverted velocity profile mode. Comparisons are presented to show the effect of configuration and flow changes on the acoustic characteristics of the nozzles. Author

N79-20830*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF GEOMETRIC AND FLOW-FIELD VARIABLES ON INVERTED-VELOCITY-PROFILE COAXIAL JET NOISE
James R. Stone 1979 30 p refs Presented at the 5th Aeroacoustics Conf., Seattle, 12-14 Mar. 1979; sponsored by AIAA
(NASA-TM-79095; E-9919) Avail: NTIS HC A03/MF A01 CSCL 20A

Relationships between the noise generation characteristics and the flow field characteristics for inverted-velocity-profile coaxial jets are discussed. Noise measurements were made at four different sideline distances in order to determine the apparent noise source locations, and flow field characteristics were determined from jet plume pressure/temperature surveys. These relationships are based on a published NASA Lewis prediction model, the basic assumptions of which are shown to be consistent with the experimental data reported herein. Improvements to the noise prediction procedure, on the basis of the present study, are included, which increase the accuracy of the high frequency noise prediction. A.R.H.

N79-20831*# Georgia Inst. of Tech., Atlanta.
APPLICATION OF FINITE ELEMENT TECHNIQUES IN PREDICTING THE ACOUSTIC PROPERTIES OF TURBOFAN INLETS Interim Technical Report
R. K. Majjigi, R. K. Sigman, and B. T. Zinn [1978] 194 p refs
(Grant NsG-3036)
Avail: NTIS HC A09/MF A01 CSCL 20A

An analytical technique was developed for predicting the acoustic performance of turbofan inlets carrying a subsonic axisymmetric steady flow. The finite element method combined with the method of weighted residuals is used in predicting the acoustic properties of variable area, annular ducts with or without acoustic treatments along their walls. An approximate solution for the steady inviscid flow field is obtained using an integral method for calculating the incompressible potential flow field in the inlet with a correction to account for compressibility effects. The accuracy of the finite element technique was assessed by comparison with available analytical solutions for the problems of plane and spinning wave propagation through a hard walled annular cylinder with a constant mean flow. A.R.H.

N79-20832*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF DURATION AND OTHER NOISE CHARACTERISTICS ON THE ANNOYANCE CAUSED BY AIRCRAFT-FLYOVER NOISE
David A. McCurdy and Clemans A. Powell Mar. 1979 47 p refs
(NASA-TP-1386; L-12579) Avail: NTIS HC A03/MF A01 CSCL 20A

A laboratory experiment was conducted to determine the effects of duration and other noise characteristics on the annoyance caused by aircraft-flyover noise. Duration, doppler shift, and spectra were individually controlled by specifying aircraft operational factors, such as velocity, altitude, and spectrum, in a computer synthesis of the aircraft-noise stimuli. This control allowed the separation of the effects of duration from the other main factors in the experimental design: velocity, tonal content, and sound pressure level. The annoyance of a set of noise stimuli which were comprised of factorial combinations of a 3 durations, 3 velocities, 3 sound pressure levels, and 2 tone conditions were judged. The judgements were made by using a graphical scale procedure similar to numerical category scaling. Each of the main factors except velocity was found to affect the judged annoyance significantly. The interaction of tonal content with sound pressure level was also found to be significant. The duration correction used in the effective-perceived-noise-level procedure, 3 dB per doubling of effective duration, was found to account most accurately for the effect of duration. No significant effect doppler shift was found. L.P.

N79-20833# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.
CONSISTENT ENVIRONMENTAL ACOUSTICS: APPLICATIONS TO STOCHASTIC INTERNAL-WAVE MODELS
W. L. Siegmann, M. J. Jacobson, and J. G. Watson 1 Dec. 1978 75 p refs
(Contract N00014-76-C-0288)
(AD-A062312; RPI-MATH-121) Avail: NTIS HC A04/MF A01 CSCL 20/1

A consistent environmental-acoustic model for a deep moving ocean is formulated. The acoustic model for regularly-perturbed SOFAR rays is approximately solved using a type of WKB(J) expansion. Interfacing conditions between the hydrodynamics and acoustics are developed which lead to constraints on acoustic frequency and transmission range. As an application, transmissions are considered through stochastic internal-wave fields, which have been modeled in a previously-published paper by the authors. Formulas for ray phase variances are derived. These formulas are asymptotically evaluated for rays with relatively significant depth variation, using the stationary phase method. New results are obtained for the dependence of the variances on internal-wave primitives, such as energy spectra. Expected multipath intensity is calculated for transmission through an ocean with static state modeled by a bilinear sound-speed profile. The effects of the internal-wave field and of varying internal-wave parameters on the expected intensity are shown to be significant. Author (GRA)

N79-20834# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AIRFRAME AERODYNAMIC NOISE-TOTAL RADIATED ACOUSTIC POWER APPROACH Final Report, Jan. 1976 - Jan. 1978
Leonard L. Shaw Nov. 1978 80 p refs
(AF Proj. 2401)
(AD-A062861; AFFDL-TR-78-141) Avail: NTIS HC A05/MF A01 CSCL 01/1

During flight the noise radiated by aircraft is emanating from two distinct types of sources. One source is the propulsion system and the other is the non-propulsion system noise, or airframe noise, associated with movement of the aircraft through the atmosphere. The purpose of this effort was to study the air-frame noise using a total radiated acoustic power approach. Methodology was developed to accurately calculate the total acoustic power by using measurements from an array of microphones during aircraft flyover. This methodology was applied to Schweizer 2-32 glider flyovers and it was found that for an aerodynamic configuration(no flaps, wheels, wheel wells, etc.) the total acoustic power can be obtained from one flyover measurement by assuming the directivity is nearly equal in all directions. This assumption was shown to be valid for the glider and is assumed valid for any aircraft in an aerodynamic configuration. The detailed methodology developed is still useful since most commercial aircraft land in a non-aerodynamic configuration and thus their directivity is not equal in all directions. The results from the glider tests were compared to data in the literature and found to agree well. Variation of the total power with aircraft velocity followed a V to the sixth power law. The parameter which normalizes the overall acoustic power from different aircraft was found to be the wing area. Author (GRA)

N79-20835# Case Western Reserve Univ., Cleveland, Ohio. Ultrasonics Research Lab.
ULTRASONIC VIBRATION POTENTIALS
Raoul Zana and Ernest Yeager 15 Nov. 1978 85 p refs
(Contract N00014-75-C-0557)
(AD-A062581; TR-45) Avail: NTIS HC A05/MF A01 CSCL 20/1

Vibration potentials are generated when sound waves are propagated through an ionic solution, polyelectrolyte or colloidal suspension in an electrolyte. Accurate measurements of vibration potential can be now performed on a routine basis, using pulse modulated ultrasonic waves for the generation of the effect, in a variety of solvents and solvent mixtures. The results obtained thus far have been used to check the theoretical treatments of the ultrasonic vibration potentials. Moreover the combination of vibration potential and density data has provided us with the partial molal volumes of ions in a series of solvents. These data should prove useful in checking theories dealing with electrostriction once they can accurately be split into a geometric contribution, and a contribution due to ion-solvent interactions. There have been relatively few investigations of polyelectrolyte solutions and colloidal systems by means of vibration potentials, although the study of these systems should prove interesting. Vibration potentials may be useful for the monitoring of changes of potential of colloidal suspensions upon addition of various agents, in some industrial processes of major importance such as paper processing. Author (GRA)

N79-20836# National Bureau of Standards, Washington, D. C. National Engineering Lab.
ULTRASONIC TRANSDUCER POWER OUTPUT BY MODULATED RADIATION PRESSURE, WITH DETAILS Final Technical Report
M. Greenspan and F. R. Breckeridge Jul. 1978 58 p refs
(Contract N00014-78-F-0007; NR Proj. 384-303)
(AD-A063096; NBSIR-78-1520) Avail: NTIS HC A04/MF A01 CSCL 17/1

We have set up and are using an apparatus for the measurement of total sound power output of a piezoelectric transducer radiating into water. This apparatus combines the better features of previously used methods which depend on radiation pressure. The input is modulated at a low frequency and the output power is intercepted by a target which experiences a force at the modulation frequency. The target is mounted on the armature of an electromagnetic receiver provided with an independent coil through which a current at the modulation frequency is adjusted in amplitude and phase, either manually or automatically by feedback, to arrest the motion of the armature. When the armature is stationary the force depends only on the current, and the apparatus can be calibrated using direct current and dead weights. It is thus absolute. In practice, the carrier frequency is swept over any part of the range 0.1 to 15 MHz while a recording of power output versus frequency is made. The results of comparisons made with those of other methods are encouraging. Examples of curves from normal and defective transducers are shown. Author (GRA)

N79-20975# European Space Agency, Paris (France).
REMARKS ON THE NOISE EMITTED BY A TURBOMACHINE JET
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-2 (ESA-TT-496) Nov. 1978 p 1-14 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-2, Mar.-Apr. 1978 p 53-58 Original report in FRENCH previously announced as A78-38696 (For primary document see N79-20974 11-99)
Avail: NTIS HC A05/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N79-20837 Princeton Univ., N. J.
ENERGY TRANSFER PROCESSES IN MOLECULAR SYSTEMS Ph.D. Thesis
Ramakrishna Ramaswamy 1978 306 p
Avail: Univ. Microfilms Order No. 7905641

Three-dimensional quantum mechanical calculations in the effective potential approximation of Rabitz were made on the para-hydrogen system. At low temperatures vibration-rotation energy transfer was examined, while the high temperature behavior of H2-H2 collisions was studied in the breathing sphere approximation. It was found that simultaneous vibrational and rotational processes contribute to the overall mechanism of vibrational relaxation. The transfer of energy from one molecule to the other as well as the conversion of internal energy to translational energy are possible in this calculation, and the corresponding cross-sections are examined in detail. Kinetic rates are calculated from the cross-sections and compared with experiment. Dissert. Abstr.

N79-20838 California Univ., Berkeley.
COHERENCE AND RELAXATION IN ENERGY TRANSFER PROCESSES IN CONDENSED PHASES Ph.D. Thesis
Robert McKinnon Shelby 1978 239 p
Avail: Univ. Microfilms Order No. 7904603

Emphasis is placed on understanding the role of coherence and interactions which tend to destroy the coherence. In the case of triplet excitons at low temperatures, the importance of coherence parameters can be experimentally determined. In the case of vibrational excitations, both picosecond spectroscopic studies of vibrational relaxation and spontaneous Raman spectroscopy are used to characterize the dynamics and give increased insight into the nature of the mechanisms responsible for vibrational dephasing. The design and operation of the picosecond apparatus used in these experiments is also described. Dissert. Abstr.

N79-20839 Carnegie-Mellon Univ., Pittsburgh, Pa.
MODEL STUDIES FOR THE ANALYSIS OF SCATTERED INTENSITIES FROM X-RAY AND HIGH ENERGY ELECTRON DIFFRACTION Ph.D. Thesis
Joel Epstein 1978 330 p
Avail: Univ. Microfilms Order No. 7904879

The momentum distribution and Compton profile of H2(1 sigma g +) are calculated and compared with results from the corresponding SCF wavefunction. The effects of electron correlation are to redistribute the momentum density, reducing the value of J(0). More than 50 percent of the redistribution is

due to differences between the first natural orbital and the SCF orbital. Total and elastic intensities of X-rays and high-energy electrons scattered by diatomic molecules are calculated within the first Born approximation from near-Hartree-Fock-quality wavefunctions. Results are presented for N2(1 sigma g +), CO(1 sigma g +), and O2(3 sigma g -). Preliminary results are for the valence charge density of imidazole, determined from x-ray and neutron diffraction at approximately -170 C using Stewart's rigid pseudoatom model. Dissert. Abstr.

N79-20840# California Univ., Berkeley. Dept. of Chemical Engineering.

MOLECULAR THEORY OF VISCOELASTICITY FOR HOMOGENEOUS BLOCK AND GRAFT COPOLYMERS

David Soong and Mitchel Shen Dec. 1978 29 p refs
(Contract N00014-75-C-0955)
(AD-A062662; TR-22) Avail: NTIS HC A03/MF A01 CSCL 07/4

The Rouse-Bueche-Zimm molecular theory of viscoelasticity has been extended to compute the retardation time spectra of radial block and graft copolymers of various configurations and compositions. The basic assumption of the model is that the effect of the presence of foreign blocks and grafts on the retardation spectrum is due to the difference in the friction coefficients. Mathematically this modification is accomplished by introducing into the equations of motion a frictional coefficient matrix. Retardation spectra can then be obtained by numerically solving for the eigenvalue spectrum on a computer. Results show that the viscoelastic retardation spectra and maximum retardation times of those copolymers vary as a function of the number of side chains, their lengths and the spacings between them. The model is restricted to bulk homogeneous copolymers, or those copolymers dissolved in appropriate solvents without microphase separation. GRA

N79-20841# Georgia Inst. of Tech., Atlanta. School of Physics.

CALCULATION OF ELECTRON IMPACT CROSS SECTIONS FROM METASTABLE STATES Final Report, 8 Oct. 1973 - 7 Oct. 1977

M. Raymond Flannery Aug. 1978 216 p refs
(Contract F33615-74-C-4003; F33615-76-C-2003; AF Proj. 2301)
(AD-A062163; AFAPL-TR-78-58) Avail: NTIS HC A10/MF A01 CSCL 07/4

A multi-channel eikonal theoretical treatment of atomic collisions is developed with electron-metastable atom collisions in mind. The treatment is applied to electron-impact excitation of hydrogen and helium atoms in their ground state and of helium initially in its metastable level. Differential integral cross sections are calculated together with the orientation and alignment parameters. Cross sections for ionization of metastable rare-gas atoms and of metastable nitrogen and carbon monoxide molecules by collision with electrons are also calculated as a function of electron impact energy. Author (GRA)

N79-20842# Georgia Inst. of Tech., Atlanta. School of Physics.

SELECTED TOPICS FROM THE THEORY OF ELECTRON-ATOM AND ATOM-ATOM COLLISIONS Interim Report, Mar. 1976 - Mar. 1978 Ph.D. Thesis

Walter Fredrick Morrison and M. R. Flannery Aug. 1978 201 p refs
(Contract F33615-76-C-2033; AF Proj. 2301)
(AD-A062610; AFAPL-TR-78-57) Avail: NTIS HC A10/MF A01 CSCL 20/8

The quantal elastic, diffusion and viscosity cross-sections have been calculated for proton-helium, neon, argon, krypton, potassium ion-helium, neon and lithium ion-helium systems by means of standard phase shift sums over angular momentum. The classical diffusion and viscosity cross-sections for the above ion-rare gas systems and for the potassium ion-argon, lithium ion-neon, argon and sodium ion-helium, neon, argon were also calculated. At low relative momenta, the classical cross-sections serve only as a 'mean' about which the quantal cross sections oscillate, but the agreement improves with increasing relative momenta. The Vainshtein, Presnyakov and Sobel'man approximation was shown to be applicable to the excitation of metastable helium by electron impact. The cross-section up to 500 eV for electron-metastable helium collisions were calculated. Contrary to expectation, excitation to the optically-forbidden levels dominate that to the optically-allowed levels at energies below 100eV. The use of the Massey-Mohr approximation in the theory of atomic collisions is discussed. It is shown to have rather general application. Author (GRA)

N79-20843# Boston Coll., Chestnut Hill, Mass.

CHEMICAL REACTIONS THAT PRODUCE ELECTRONICALLY EXCITED METAL ATOMS Final Report, 1 Mar. 1975 - 30 June 1978

Paul Davidovits 31 Oct. 1978 17 p refs
(Grants AF-AFOSR-2822-75; AF Proj. 2303)
(AD-A062130; AFOSR-78-1503TR) Avail: NTIS HC A02/MF A01 CSCL 11/2

Techniques have been developed for the study of highly exoergic reactions of boron and carbon atoms. Merged flow, diffusion and single collision experiments were performed to measure total reaction cross sections, chemiluminescence cross sections and population distributions in the electronically excited states of reaction products. The basic purpose of these studies was to gather a body of systematic data in order to understand the reaction mechanism and the production of electronically excited states for this important class of non-metal atom reactions. GRA

N79-20844# Naval Research Lab., Washington, D. C. Laser Plasma Branch.

SECONDARY ELECTRON EMISSION BY ENERGETIC IONS INCIDENT ON METAL SURFACES

R. Decoste and B. H. Ripin Aug. 1978 15 p refs
(AD-A062102; NRL-MR-3814) Avail: NTIS HC A02/MF A01 CSCL 20/9

An experimental technique, especially well adapted to measure secondary electron coefficients for energetic ions incident on any charge collector surface, is described. The technique uses a laser-produced plasma as an ion source, a high-energy ion analyzer as an ion energy and species filter and a tubular electrode arrangement to suppress or attract the secondary electrons at the charge collectors. The secondary electron coefficients for several ionization states of carbon and hydrogen ions incident on copper surfaces are given as a function of incident ion energy between 15 and 150 keV/Z. Author (GRA)

N79-20845# SRI International Corp., Menlo Park, Calif.

MECHANISMS OF MULTIPHOTON DISSOCIATION OF MOLECULAR IONS Progress Report, Mar. - Nov. 1978

Michael J. Coggiola and J. R. Peterson 4 Dec. 1978 4 p
(Contract N00014-76-C-1035)
(AD-A062461; SRI-MP-78-123) Avail: NTIS HC A02/MF A01 CSCL 07/4

The dynamics of multiphoton absorption and dissociation of polyatomic ions will be studied to characterize the details of the process. Ion fragments will be identified and the energy released into translation will be measured using a coaxial laser ion beam spectrometer. Single photon absorption studies of positive and negative polyatomic ions failed to reveal any vibrational absorptions in the infrared region investigated. A single photon electronic transition absorption in O2(-) was found which resulted in dissociation. Author (GRA)

N79-20846# SRI International Corp., Menlo Park, Calif.

INELASTIC COLLISIONS OF EXCITED ATOMS Progress Report, Mar. - Nov. 1978

Keith T. Gillen and Michael J. Coggiola 22 Nov. 1978 4 p refs
(Contract N00014-76-C-0118)
(AD-A062467; SRI-MP-78-124) Avail: NTIS HC A02/MF A01 CSCL 20/5

This report describes the development and verification of a technique for optically pumping fast metastable rare gas beams in order to monitor, and then substantially alter, the beam composition. The technique has been successfully applied to a neon metastable beam produced by charge transfer of neon ions in sodium at energies near 1 keV. Author (GRA)

N79-20847# Princeton Univ., N. J. Dept. of Chemistry.
STUDIES IN MOLECULAR COLLISION PHENOMENA Progress Report, 1 Nov. 1977 - 30 Nov. 1978
Herschel Rabitz 30 Nov. 1978 14 p refs
(Contract N00014-75-C-0478)
(AD-A062762; PR-7) Avail: NTIS HC A02/MF A01 CSCL 07/4

Molecular dynamics studies at Princeton are reviewed. The areas of research involved are: (1) inelastic molecular collisions, (2) stochastic theory of molecular dynamics, (3) inversion of relaxation data, and (4) sensitivity theory. Author (GRA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N79-20848 Rensselaer Polytechnic Inst., Troy, N. Y.
INVESTIGATIONS OF LWR DESIGN MODIFICATIONS FOR IMPROVED FUEL UTILIZATION IN ONCE-THROUGH CYCLE Ph.D. Thesis
Erler Schall Amorim 1978 266 p
Avail: Univ. Microfilms Order No. 7903218

Neutronics aspects of a reactor core throughout its cycle are investigated in a search for increasing in-core utilization of the residual fissile isotopes content in the cycle discharged disposal. Design considerations are explored in order to account for power peaking due to water gaps and for convenient neutron leakage leading to a utilization of burnup dependent effective bucklings and cross sections. At convenient burnup levels, changes in H2O/UO2 volume ratio are introduced allowing an intense depletion of the residual fissile isotopes existing in assemblies with high exposure levels. The effects of design changes are evaluated from an interplay of different nuclear parameters for pin cell, assembly and core calculations. A systematic analysis of industrial methodology and available data guided the development of an analytical model that reproduced several nuclear parameters with an accuracy similar to those from more complete models and with a reduced computational effort. Dissert. Abstr.

N79-20849 Maryland Univ., College Park.
INCLUSIVE PARTICLE PRODUCTION IN POSITRON ELECTRON INTERACTIONS IN THE 6 AND 7 GeV CENTER-OF-MASS ENERGY REGIONS Ph.D. Thesis
David Henry Badtke 1978 407 p
Avail: Univ. Microfilms Order No. 7905480

The measurements were obtained using a small solid angle (Delta Omega sub MAX = 0.086 sr) magnetic spectrometer situated at 90 degrees + or - 13 degrees with respect to the beams. The spectrometer and a conjugated detector opposite the spectrometer were used to measure back-to-back Babhas and muons, and the latter were used to normalize the results. Hadron inclusive spectra are presented for p > 400 MeV/c, and the results at high energy are compared with previous results at square root of s = 4.8 GeV. Hadron average charge particle multiplicities are investigated using a simple model for the e(+)e(-) final state. Dissert. Abstr.

N79-20850 Maryland Univ., College Park.
COVARIANT HARMONIC OSCILLATORS AND THE QUARK MODEL Ph.D. Thesis
Michael Joseph Ruiz 1978 97 p
Avail: Univ. Microfilms Order No. 7905461

A bound state model is reviewed and developed. The general overlap integral of covariant harmonic oscillators in different Lorentz frames is evaluated. The model is applied in calculating the axial-vector coupling constants in weak interactions. Hyperfine splittings of nonstrange hadrons and charmonium are investigated with a relativistic gluon-exchange model. A formula is derived relating the Delta-N and rho-pi mass differences where color and internal quark motion play an important role. Dissert. Abstr.

N79-20851# Harry Diamond Labs., Adelphi, Md.
AURORA ELECTRON BEAM MODIFICATION
Stewart E. Graybill Jul. 1978 38 p refs
(AD-A062931; HDL-TR-1862) Avail: NTIS HC A03/MF A01 CSCL 20/7

The AURORA pulser, which normally operates as a pulsed bremsstrahlung machine, has been modified to injet the electron beam from one of the four lines into a drift chamber. The beam obtained from a hemispheric cathode and a machine charging voltage of 90 kv has been studied in detail. This beam of 8 MeV, 240 kA, 200 ns, 300 kJ has produced energy fluences of 10 to 500 cal sq. in. The energy deposition profile in three materials has been measured and calculated with reasonable agreement. The beam has been successfully used for structures testing, fluidics circuit irradiation, high intensity bremsstrahlung production, and collective ion acceleration. GRA

N79-20852# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Nuclear Engineering.
TWO-PHASE FLOW PHENOMENA IN NUCLEAR REACTORS TECHNOLOGY Quarterly Progress Report, 1 Mar. 1978 - 31 May 1978
R. T. Lahey, Jr. Oct. 1978 98 p refs
(Contract NRC-04-76-301)
(PB-290317/7; NUREG-CR-0418; QPR-8) Avail: NTIS HC A05/MF A01 CSCL 18I

Flow phenomena associated with certain hypothetical nuclear accidents are discussed with emphasis on the development of reliable, inexpensive and easily interpretable, two-phase flow instrumentation with which some basic two-phase flow parameters can be measured (e.g., void fraction, phase velocity,etc). Two-phase flow multidimensional void distribution mechanism and phase separation effects rent safety question concerning the performance of the BWR emergency core cooling (ECC) system is addressed. Particular emphasis will be placed on parallel channel effect during ECC operation. GRA

N79-20853# National Bureau of Standards, Washington, D. C.
ANALYTICAL METHODS FOR SAFEGUARDS AND ACCOUNTABILITY MEASUREMENTS OF SPECIAL NUCLEAR MATERIALS
H. Thomas Yolken and John E. Bullard (Babcock and Wilcox Co., Lynchburg, Va.) Nov. 1978 297 p Presented at Amer. Nucl. Soc. Topical Meeting, Williamsburg, Virginia, 15-17 May 1978
(PB-289112/5; NBS-SP-528) Avail: NTIS HC A13/MF A01 CSCL 18I

The latest techniques for chemical analysis of special nuclear materials and to strengthen lines of communication among scientists working in this field were discussed. Advanced analytical chemistry techniques, mathematical correction models, and wet chemistry methods for elemental content are included. Examples of remote systems for handling highly radioactive samples for analysis are given. Progress was made on the problems associated with obtaining high precision and accuracy for analysis of special nuclear materials. Computer-controlled operating systems with built-in safe-guards and quality assurance programs are described. Current trends in the fuel cycle, along with future approaches to control and accountability of special nuclear materials, are discussed. GRA

N79-20854# National Bureau of Standards, Washington, D. C.
MEASUREMENTS AND STANDARDS FOR NUCLEAR MATERIALS SAFEGUARDS Quarterly Technical Report, 1 May 1978 - 1 Sep. 1978
H. T. Yolken and F. E. Jones Dec. 1978 29 p refs
(Contract AT(49-25)-9009)
(PB-291354/9; NUREG-CR-0533) Avail: NTIS HC A03/MF A01 CSCL 18G

The overall approach that NBS is using to provide for development and dissemination of a consistent set of national measurement standards for nuclear materials safeguards is presented. A great deal of work needs to be done to provide the standardization base for alternate fuel cycles. Many materials such as thorium, uranium 233, and plutonium or mixed oxides 'spiked' with fission products might well be found in future alternate fuel cycles. The NBS program is aimed at providing both the standards for today's needs and the standards for future

fuel cycles. A summary of the progress for each of the tasks in the project is given. GRA

74 OPTICS

Includes light phenomena.

N79-20855 Cincinnati Univ., Ohio.
CHARGE-COUPLED DEVICE (CCD) OPTICAL WAVEGUIDE IMAGER AND APPLICATIONS Ph.D. Thesis
Chih Liang Chen 1978 252 p
Avail: Univ. Microfilms Order No. 7904720

On-chip integrated optical waveguide images for optical signal processing were investigated as a means to provide high quantum efficiency and large dynamic range for optical to electrical signal conversion. Slab waveguide imagers and channel waveguide imagers were constructed with a photodiode array-charge-coupled device (Pa-CCD) coupled to a waveguide structure by means of a tapered SiO2 layer. The PA-CCD device provides parallel-in/serial out signal multiplexing capability. The slab waveguide imager was successfully designed and fabricated and has imaged spatial laser light distributions within a slab optical waveguide. The channel waveguide imager formed by combining a four-phase, double polysilicon PA-CCD device with a preferentially-etched, V-groove channel waveguide array was operated successfully to detect laser light coupled into the channel waveguide array through an on-chip V-groove and coupler. Dissert. Abstr.

N79-20856* National Aeronautics and Space Administration. Pasadena Office, Calif.
SYSTEM AND METHOD FOR OBTAINING WIDE SCREEN SCHLIEREN PHOTOGRAPHS Patent
Shakkottai P. Parthasarathy, inventor (to NASA) (JPL) Issued 13 Feb. 1979 4 p Filed 9 Feb. 1978 Supersedes N78-18396 (16 - 09, p 1160) Sponsored by NASA
(NASA-Case-NPO-14174-1; US-Patent-4,139,291; US-Patent-Appl-SN-876441; US-Patent-Class-354-77; US-Patent-Class-250-237G; US-Patent-Class-356-129) Avail: US Patent and Trademark Office CSCL 20F

A system for use in Schlieren photography includes (1) a viewing screen adjacently related to a large grating; (2) a small grating disposed in spaced relation with the large grating; (3) a transparent retainer for confining a transparent medium between the gratings; and (4) optics for imaging the small grating on the large grating. A light source and optically aligned lens are used to project a beam of light along axes extending through the small grating and strike the large grating, subsequent to passing through the medium. A Schlieren image of striations resulting from distortions of light rays proposed by the medium are formed on the screen. A camera is used to photograph the Schlieren image projected on the large screen.
Official Gazette of the U.S. Patent and Trademark Office

N79-20857* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW INTENSITY X-RAY AND GAMMA-RAY IMAGING DEVICE Patent
Lo I. Yin, inventor (to NASA) Issued 27 Feb. 1979 9 p Filed 20 Jul. 1977 Supersedes N77-29471 (15 - 20, p 2674)
(NASA-Case-GSC-12263-1; US-Patent-4,142,101; US-Patent-Appl-SN-817415; US-Patent-Class-250-363R; US-Patent-Class-250-483) Avail: US Patent and Trademark Office CSCL 20F

A radiation to visible light converter is combined with a visible light intensifier. The converter is a phosphor or scintillator material which is modified to block ambient light. The intensifier includes fiber optics input and output face plates with a photocathode-microchannel plate amplifier-phosphor combination. Incoming radiation is converted to visible light by the converter which is piped into the intensifier by the input fiber optics face plate. The photocathode converts the visible light to electrons which are amplified by a microchannel plate amplifier. The electrons are converted back to light by a phosphor layer and piped out for viewing by the output fiber optics faces plate. The converter-intensifier combination may be further combined with its own radiation source or used with an independent source.
Official Gazette of the U.S. Patent and Trademark Office

N79-20858*# Hughes Research Labs., Malibu, Calif.
SINGLE FIBER STAR COUPLERS Final Report, 15 Aug. 1978 - 15 Feb. 1979
C. K. Asawa 1979 54 p refs Prepared for JPL
(Contract JPL-955200)
(NASA-CR-158377) Avail: NTIS HC A04/MF A01 CSCL 20F

An ion exchange process was developed and used in the fabrication of state-of-the-art planar star couplers for distribution of optical radiation between optical fibers. An 8 x 8 planar transmission star coupler was packaged for evaluation purposes with sixteen fiber connectors and sixteen pigtails. Likewise a transmission star coupler and an eight-port reflection star coupler with eight-fiber ribbons rigidly attached to these couplers, and a planar coupler with silicon guides and a parallel channel guide with pigtails were also fabricated. Optical measurements of the transmission star couplers are included with a description of the manufacturing process. A.R.H.

N79-20859*# Athens Coll., Ala.
OPTICAL SURFACE DAMAGE FROM REENTRANT GASES ON STS Final Report
Joseph K. McDonald 8 Dec. 1979 10 p
(Contract NAS8-32483)
(NASA-CR-161183) Avail: NTIS HC A02/MF A01 CSCL 20F

The effect of an ammonia environment on the spectral reflectance of certain optical surfaces in the vacuum ultraviolet region was studied. In particular, the optical surfaces in the space shuttle were considered. Scans made of sample beams showed no change in the relative intensities before or after exposure to ammonia. Ammonia showed no effect on the Al/MgF2 mirror reflectance in the vacuum ultraviolet. M.M.M.

N79-20860*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MERGED INFRARED CATALOGUE
M. Schmitz (Computer Sciences Corp., Silver Spring, Md.), L. W. Brown, J. M. Mead, and T. A. Nagy (Computer Sciences Corp., Silver Spring, Md.) Nov. 1978 334 p
(NASA-TM-79683) Avail: NTIS HC A15/MF A01 CSCL 20F

A compilation of equatorial coordinates, spectral types, magnitudes, and fluxes from five catalogues of infrared observations is presented. This first edition of the Merged Infrared Catalogue contains 11,201 oservations from the Two-Micron Sky Survey, Observations of Infrared Radiation from Cool Stars, the Air Force Geophysics Laboratory four Color Infrared Sky Survey and its Supplemental Catalog, and from Catalog of 10 micron Celestial Objects (HALL). This compilation is a by-product of a computerized infrared data base under development at Goddard Space Flight Center; the objective is to maintain a complete and current record of all infrared observations from 1 micron m to 1000 micron m of nonsolar system objects. These observations are being placed into a standardized system. Author

N79-20861# Naval Research Lab., Washington, D. C.
COMPARISON OF LOW AND HIGH RESOLUTION INFRARED PROPAGATION MEASUREMENTS IN THE 3- TO 5-MICROMETERS ATMOSPHERIC WINDOW
K. M. Haught, J. A. Curcio, J. A. Dowling, D. H. Garcia, and C. O. Gott 9 Nov. 1978 16 p refs
(SF32344017)
(AD-A062645; NRL-8254) Avail: NTIS HC A02/MF A01 CSCL 04/1

For the limited range of meteorological conditions under which these measurements were made, the standard deviation of the transmittances measured by these two techniques is 0.06.
Author (GRA)

N79-20862# Philips Labs., Briarcliff Manor, New York.
OPTIMIZED PYROELECTRIC VIDICON THERMAL IMAGER, VOLUME 2: IMPROPER FERROELECTRIC MATERIALS Final Technical Report, 1 Sep. 1976 - 28 Feb. 1978
Wallace Arden Smith Jul. 1978 224 p refs
(Contract DAAG53-76-C-0053)

(AD-A062730) Avail: NTIS HC A10/MF A01 CSCL 17/5

A comprehensive survey of improper ferroelectrics was carried out to identify materials with potential to enhance the performance of the pyroelectric vidicon. Representatives of four families of improper ferroelectrics were selected for detailed experimental and theoretical analysis: rare-earth molybdates, the sulfate family, propionates, and boracites. A thorough experimental and theoretical characterization of the rare-earth molybdates confirmed the expectation that the dielectric anomaly could be nearly absent in improper ferroelectrics and thus lead to a high value of the figure-of-merit p/epsilon c. Experimental confirmation of the theoretical models allows one to obtain an optimized figure-of-merit of 10,000 sq cm/C for materials of this family as compared to 3,000 sq cm/C for TGS at 40 C). From the sulfate family, lithium ammonium sulfate and its deuterated analog exhibited a room-temperature value of the figure-of-merit about equal to that of TGS at 40 C. The other analog sulfates examined exhibited a characteristically different behavior and smaller values for the figure-of-merit. GRA

N79-20863# Oregon Graduate Center, Beaverton. Dept. of Applied Physics and Electronic Science.

STRONG OPTICAL SCATTERING IN ATMOSPHERE TURBULENCE Final Report, 1 Aug. 1977 - 31 Jul. 1978

Richard A. Elliott, J. Richard Kerr, and Philip A. Pincus 30 Sep. 1978 60 p refs

(Grant AF-AFOSR-3401-77)

(AD-A062763; AFOSR-78-1519TR) Avail: NTIS HC A04/MF A01 CSCL 04/1

A versatile and useful facility for simulating the effects of atmospheric turbulence on optical propagation is described and the relevant system parameters characterized. The scattering medium is a turbulent liquid (ethanol) with the turbulence created by unstable convection generated by a strong vertical thermal gradient. Measurements of the structure function and the spatial spectrum of the resulting refractive index fluctuations are presented and compared with the theoretically predicted forms. The effects of this scattering medium on laser beam propagation are determined and compared to the first order Rytov theory. In particular probability density functions, moments and spatial covariance functions of the irradiance resulting from propagation through the system with a variety of turbulence levels and path lengths are presented. The results of an investigation into generating a controlled scattering medium by dispersing uniformly sized transparent spheres in a medium with a slightly different index of refraction is also reported. Author (GRA)

N79-20986# European Space Agency, Paris (France).

INFLIGHT UTILIZATION OF AN OPTICAL FIBER TRANSMISSION SYSTEM ON A FALCON 10 AIRCRAFT

Joseph Taillet and Jean Reibaud *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-3 (ESA-TT-522) Dec. 1979 p 98-103 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 139-141 Original report in FRENCH previously announced as A78-47349 (For primary document see N79-20980 11-99)

Avail: NTIS HC A06/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N79-20864*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ION BEAM PROBING OF ELECTROSTATIC FIELDS

Hans Persson Feb. 1979 66 p refs

(NASA-TM-X-79120; E-9953) Avail: NTIS HC A04/MF A01 CSCL 20I

The determination of a cylindrically symmetric, time-independent electrostatic potential V in a magnetic field B with the same symmetry by measurements of the deflection of a primary beam of ions is analyzed and substantiated by examples. Special attention is given to the requirements on canonical angular momentum and total energy set by an arbitrary, nonmonotone V, to scaling laws obtained by normalization, and to the analogy with ionospheric sounding. The inversion procedure with the Abel analysis of an equivalent problem with a one-dimensional fictitious potential is used in a numerical experiment with application to the NASA Lewis Modified Penning Discharge. The determination of V from a study of secondary beams of ions with increased charge produced by hot plasma electrons is also analyzed, both from a general point of view and with application to the NASA Lewis SUMMA experiment. Simple formulas and geometrical constructions are given for the minimum energy necessary to reach the axis, the whole plasma, and any point in the magnetic field. The common, simplifying assumption that V is a small perturbation is critically and constructively analyzed; an iteration scheme for successively correcting the orbits and points of ionization for the electrostatic potential is suggested. J.M.S.

N79-20865# Nagoya Univ. (Japan). Inst. of Plasma Physics.

FORMATION OF CONVECTIVE CELLS BY MODULATIONAL INSTABILITY OF DRIFT ALFVEN WAVES

J. Weiland and H. Sanuki Jan. 1979 16 p refs

(IPPJ-364) Avail: NTIS HC A02/MF A01

A model equation describing drift Alfven wave with E x B nonlinearity is derived. For a special ordering a nonlinear Schrodinger equation is derived, which governs modulational instability of the drift Alfven wave. Translational invariance is assumed along the magnetic field. The relation between the characteristic scale lengths parallel and perpendicular to the drift flow for the onset of cell formation is found to depend on if the wave propagates parallel or antiparallel to the drift flow and on the sign of the wave energy. The influence of perpendicular ion viscosity is discussed. Author

N79-20866# Nagoya Univ. (Japan). Inst. of Plasma Physics.

THE DEVELOPMENT OF SOLITON PHYSICS: AN ANALYSIS BASED ON INFORMATION RETRIEVAL

Yoshi H. Ichikawa, Takeru Ohe, and Yasumasa Kanada [1979] 23 p refs

(IPPJ-362) Avail: NTIS HC A02/MF A01

Information retrieval is used from available data bases such as INSPEC tapes in an attempt to quantify and demonstrate trends in the recent development of Soliton physics research. The date shows that Soliton physics research may be classified into three stages according to the annual numbers of published scientific papers (N): Stage 1, N - 1 Gestation (up to 1965); Stage 2, N - 10 Introduction (1966 - 1971); Stage 3, N - 100 Growth (1971 - present). G.Y.

N79-20867# Nagoya Univ. (Japan). Inst. of Plasma Physics.

NUMERICAL ANALYSIS OF CURRENT-DRIVEN COLLISIONAL DRIFT AND ALFVEN INSTABILITIES IN A SHEARED MAGNETIC FIELD

Ken-ichi Nishi-Kawa Dec. 1978 11 p refs

(IPPJ-363) Avail: NTIS HC A02/MF A01

Collisional drift eigenmode, coupled to shear Alfven mode, is studied numerically in a current-carrying slab with finite magnetic shear. It is shown that, due to finite-beta effects, in the presence of current, a drift mode becomes unstable. Author

N79-20868# Nagoya Univ. (Japan). Inst. or Plasma Physics.

ANALYSIS FOR EXTRACTION AND BUNCHING OF ION BEAM FROM SPHERICAL REFLEX TRIODE

Shigeo Kawata, Takashi Abe, Koichi Kasuya, and Keishiro Niu Nov. 1978 20 p refs

(IPPJ-360) Avail: NTIS HC A02/MF A01

An analysis was developed for the intense ion beam which is extracted from a spherical reflex triode. The basic equations used are the Poisson equation for the electric potential and the conservation equations of energies for the ion and electron velocities. According to the asymptotic solution, the extracted ion-beam-current density is proportional to the power of 3/2 of the voltage imposed on the triode. This dependence of the current density on the voltage is improved to the power of 1.6 by the numerical analysis. A special time-dependence of the ion-beam power at the target surface is required for an optimal implosion of the target. Using the bunching theory for the ion beam, a numerical derivation of an optimal time-dependence of the voltage

imposed on the triode is presented. Asymptotic forms are also obtained analytically for the voltage. Author

N79-20868# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NUMERICAL INVESTIGATION OF CURRENT DRIVEN DISSIPATIVE DRIFT WAVE TURBULENCE INCLUDING FINITE BETA AND QUASILINEAR EFFECTS IN A TOKAMAK PLASMA
Jan Weiland [1978] 32 p refs
(IPPJ-361) Avail: NTIS HC A03/MF A01

Excitation of dissipative drift wave turbulence with waves propagating perpendicular to the density gradient is studied numerically, taking an average over the gradient coordinate. Both situations where the plasma current is the main source of instability and situations more close to an ordinary dissipative drift wave excitation were investigated in the presence of finite beta effects and ion viscosity. The main saturation mechanism was quasilinear modification of the background density. In addition to the usual current induced growth, the current is also found to decrease the finite beta stabilization. Author

N79-20870# Naval Research Lab., Washington, D. C.
QUEST: A QUASI-EQUILIBRIUM TRANSPORT CODE FOR HIGH-BETA SYSTEMS
B. H. Hui, P. C. Liewer, and D. L. Book Jul. 1978 69 p refs (AD-A062418; AD-E000237; NRL-MR-3813) Avail: NTIS HC A04/MF A01 CSCL 20/9

This report describes the quasi-equilibrium compression and transport code, QUEST. The code is designed to study diffusion, thermal conduction, and ohmic and compressional heating in high-beta plasma systems (beta - ratio of plasma pressure to magnetic field pressure). These systems include Z-pinches, theta pinches, belt pinches and reversed field configurations. The code allows variations only in the radial direction and operates on a slow (diffusion and compression) time scale so that pressure balance is maintained. The conducting wall at the outer boundary of the system can be moved arbitrarily to simulate plasma compression produced by an imploding liner. This report also provides instructions on the use of the code, including a listing and sample input and output for verification.
Author (GRA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N79-20871 Ohio State Univ., Columbus.
SOME EFFECTS OF ION IMPLANTATION ON A MAGNETIC BUBBLE GARNET THIN FILM Ph.D. Thesis
Joseph Philip Omaggio 1978 156 p
Avail: Univ. Microfilms Order No. 7902198

Bubble garnets are magnetoelastic and it is shown that this type of strain adds a term to the system energy which is uniaxial in nature. The effects of ion implantation on this uniaxial anisotropy energy for a particular wafer were studied. Samples cut from this wafer have been implanted with 800 KeV helium ions at doses from 10 to the 15th power to 3 to the 16th power ions/cm squared. The films exhibit multi-resonance FMR (ferromagnetic resonance) spectra which indicate an appreciable variation of Hu-4 pi M (the uniaxial anisotropy field, Hu, minus 4 pi times the saturation magnetization, M) across the film thickness. The change in Ku (which is proportional to lattice expansion) is a measure of the damage incurred during implantation. Measurements of Ku indicate that for low doses damage increases linearly with dose. At higher doses the curve begins to level off. At these doses the damage regions around the projectile tracks are probably beginning to overlap.
Dissert. Abstr.

N79-20872 Minnesota Univ., Minneapolis.
SUPERCONDUCTING THIN FILMS AND TUNNELING JUNCTIONS OF Nb3G3E1 Ph.D. Thesis
Roman Horacio Buitrago 1978 111 p
Avail: Univ. Microfilms Order No. 7906290

Significant progress was made in preparing high quality superconducting tunneling junctions of Nb3Ge although it is difficult to fabricate such junction because of Nb3Ge's short coherence length and the condition of the surface chemistry of the films. Successful junctions using an artificial barrier of Al2O3 were made by first precleaning the Nb3Ge films and simultaneously altering the surface's stoichiometry to a more appropriate value, second, depositing a thin layer of Al which is then fully oxidized, and third, depositing a counter electrode of Pb. Auger electron spectroscopy. Auger electron spectroscopy was used to monitor the thickness of the Al prior to oxidation. The cleaning process, unfortunately, damages slightly the top surface of Nb3Ge. Ways of minimizing this damage are discussed. Dissert. Abstr.

N79-20873 Stanford Univ., Calif.
IN SITU ANALYSIS USING MOLECULAR BEAM-MASS SPECTROMETRY-APPLICATION TO CRYSTAL GROWTH Ph.D. Thesis
Haiping Dun 1978 150 p
Avail: Univ. Microfilms Order No. 7905848

A molecular beam sampling technique which consists of a three stage differentially pumped system with expansion through a diverging conical nozzle in the first stage is described. The gasdynamics for the expansion through the conical nozzle sampling orifice was characterized by probing the gas density distribution of the flow field inside the nozzle with a movable conical skimmer orifice. Palladium diffused hydrogen was analyzed and the major impurity species detected were H2O, CO and CH4 in the ppm range. A proposed reaction between quartz and hydrogen at elevated temperature was confirmed by the detection of SiO in the vapor at concentration levels close to levels predicted from existing thermodynamic data. The influence of these impurities on the liquid epitaxial growth of GaAs is discussed.
Dissert. Abstr.

N79-20874 North Carolina State Univ. at Raleigh.
SELF-DIFFUSION OF CARBON-14 AND SILICON-30 IN POLYCRYSTALLINE BETA SILICON CARBIDE Ph.D. Thesis
Min-Hsiung Hon 1978 195 p
Avail: Univ. Microfilms Order No. 7905507

The study of the self-diffusion of C-14 and Si-30 in highest purity, essentially intrinsic polycrystalline beta-SiC in order to determine the kinetics of both volume and grain boundary mass transport and to understand the crystallographic mechanisms which are operative in these processes in this material is presented. Isotopic tracers of Si-14C or (Si-30)-(Si-30) combination were deposited on the sample surfaces, heated in the range of 2128-2547 K to produce diffusion profiles which were determined using a gas proportional counter (C) or an ion microprobe (Si) and mathematically analyzed by computer. The results show that C is the faster diffusion species. Carbon grain boundary self-diffusion coefficients analyzed using the Suzuoka equation are five to six orders of magnitude faster than that in the volume. A vacancy mechanism of diffusion is assumed, and various transport paths are evaluated. Thermodynamic considerations of the diffusion results are also presented. Dissert. Abstr.

N79-20875 California Univ., Berkeley.
VALENCE BAND PHOTOEMISSION STUDIES OF CLEAN METALS Ph.D. Thesis
Paul Sherman Wehner 1978 118 p
Avail: Univ. Microfilms Order No. 7904644

The application of Angle-Resolved Photoelectron Spectroscopy to crystalline solids and the utilization of such studies to illuminate several questions concerning the detailed electronic structure of such materials, are discussed. Specifically, by construction of a Direct Transition model and the utilization of energy-dependent angle-resolved normal photoemission, the bulk band structure of copper is experimentally mapped out along three different directions in the Brillouin Zone; gamma to K, gamma to L, and gamma to X. In addition, various effects which influence the obtainable resolution in k-space, namely, thermal disorder, momentum broadening, and band mixing, are discussed and are shown to place severe limitations on the applicability of the DT model. Finally, a model for Angle-Resolved X-ray Photoelectron Spectroscopy based on the symmetry of the initial-state wavefunctions is presented and compared to

experimental results obtained from copper single crystals.
Dissert. Abstr.

N79-20876 California Univ., Berkeley.
VIBRATIONAL RELAXATION AND ENERGY TRANSFER OF MATRIX ISOLATED HCl AND DCl Ph.D. Thesis
Jay Martin Wiesenfeld 1978 385 p
Avail: Univ. Microfilms Order No. 7904651

Vibrational kinetic and spectroscopic studies were performed on matrix-isolated HCl and DCl between 9 and 20 K. Vibrational relaxation rates for v=2 and v=1 were measured by a tunable infrared laser-induced, time-resolved fluorescence technique. In an Ar matrix, vibrational decay times are faster than radiative and it is found that HCl relaxes about 35 times more rapidly than DCl, in spite of the fact that HCl must transfer more energy to the lattice than DCl. Dissert. Abstr.

N79-20877 California Univ., Berkeley.
ANGLE-RESOLVED PHOTOELECTRON SPECTROSCOPY APPLIED TO THE DETERMINATION OF THE SURFACE ELECTRONIC STRUCTURE OF CRYSTALLINE METALS Ph.D. Thesis
Richard Stanley Williams 1978 183 p
Avail: Univ. Microfilms Order No. 7904652

Photoemission from atomic neon was examined theoretically to learn the nature of the continuum final state and the relationship to the total and differential atomic cross-sections. The directionality of the band-like final states in a crystalline solid is then determined by examining angle-resolved photoelectron spectra (ARPES) collected from Cu single crystals. The surface sensitivity of plasmon loss satellites in photoemission spectra of Al and In was studied. The effect of photocurrent damping on ARPES valence band spectra of copper was then investigated by examining the relaxation of crystal momentum selection rules with increased surface sensitivity. The dynamic effects of thermal lattice disordering are shown to be extremely important in photoemission studies applied to band structure determinations, as electron-phonon interactions can suppress the information content of an ARPES spectrum drastically. Dissert. Abstr.

N79-20878 California Univ., Santa Barbara.
MAGNETIC POLARITONS AND IMPURITY EFFECTS IN UNIAXIAL ANTIFERROMAGNETS Ph.D. Thesis
Ryan Wade Sanders 1978 279 p
Avail: Univ. Microfilms Order No. 7905573

High-resolution antiferromagnetic resonance spectra of single crystals of FeF2 were measured in the far-infrared, by means of a 1.36 THz H2O laser used in conjunction with a superconducting magnet operating in the vicinity of 70 kOe. The principle result was the first observation of magnetic magnons and photons. By comparison to theory, the low temperature linewidth Delta H = 350 + or - 50 Oe, even though the overall width of the structure in the transmission spectrum is more than 15 kOe. The localized mode associated with traces of Mn in FeF2 were also observed, with a resonance intensity three orders of magnitude larger than would be expected on the basis of the Mn concentration. The EPR of dilute Fe(+2):ZnF2 was studied at X-band and FIR. The magnetically two-dimensional material K2MnF4 was studied experimentally and theoretically. Dissert. Abstr.

N79-20879 State Univ. of New York at Buffalo.
STUDIES OF THE TWO-DIMENSIONAL QUANTUM FLUIDS Ph.D. Thesis
Chung In Um 1978 98 p
Avail: Univ. Microfilms Order No. 7905328

The ring diagram approximation is used for the calculations of the excitation spectrum, thermodynamic functions, ground state energy, pair distribution function, and other quantities of 2-D liquid helium and charged bosons. It is found that for low density the excitation spectrum of charged bosons does not show a plasma mode. It is proportional to q sub 1/2 for low momenta, and reduces to the single particle excitation spectrum for high momenta. The 2-D excitation spectrum of a Bose fluid evaluated for a soft potential with a Lennard-Jones type tail is similar to the 3-D Landau quasi-particle spectrum, but the excitation spectrum for pseudopotential does not yield an analogous quasi-particle spectrum. With soft potential, the thermodynamic properties of liquid He4 can be described qualitatively and quantitatively. Dissert. Abstr.

N79-20880 Stanford Univ., Calif.
SURFACE AND INTERFACE STUDIES OF OXYGEN ON SILICON, BARRIERS Ph.D. Thesis
Charles Michael Garner 1978 157 p
Avail: Univ. Microfilms Order No. 7905865

Photoelectron spectroscopy and ion depth profiling with Auger electron spectroscopy was used to study the chemistry and topology of semiconductor interfaces. The early stages of formation of the SiO2-Si, Au-Si, and Al-Si interfaces were studied with photoelectron spectroscopy at photon energies which allow maximum surface sensitivity. The interface widths of AlxGa1-xAs-GaAs heterojunctions were studied with ion depth profiling with Auger electron spectroscopy. The surface composition of GaAs and Alx-Ga1-xAs were studied with Auger electron spectroscopy and compared to the electrical properties of Schottky barriers produced on these surfaces. The presence of As oxide in the oxide layer changes the electrical characteristics of the Schottky barriers. Dissert. Abstr.

N79-20881 California Univ., Santa Barbara.
STRUCTURE AND ORIENTATION OF MOLECULES CHEMISORBED ON ALUMINA: A TUNNELING SPECTROSCOPY STUDY Ph.D. Thesis
James Timothy Hall 1978 116 p
Avail: Univ. Microfilms Order No. 7905566

Having the sensitivity that tunneling spectroscopy brings to the study of molecules on surfaces makes it a valuable tool in surface science. Information is revealed in the position and intensity of each peak in the tunneling spectrum; (1) the structure of organic species can be determined from comparison to infrared and Raman spectra; (2) orientation of these species can be determined from the relative intensities of the peak heights; and (3) induced structural changes can be analyzed with the changes in position and intensity of the peaks. The three types of information were used to explore how a particular class of organic materials known as acids adsorbs on an alumina surface and how some of these adsorbed acids behave under electron beam bombardment typical to electron beams used in electron microprobes. Close inspection of the tunneling spectra reveals much that is not obtainable with other methods. Dissert. Abstr.

N79-20882 California Inst. of Tech., Pasadena.
OPTICAL PROPERTIES OF EXCITED SILICON AND GERMANIUM AT LOW TEMPERATURES Ph.D. Thesis
Stephen Aplin Lyon 1979 170 p
Avail: Univ. Microfilms Order No. 7904853

High resolution photoluminescence data for Si doped with Al, Ga, and In are presented. Measurements of the bound exciton lifetimes for the four common acceptors in Si and for the first two bound multi-exciton complexes in Si:Ga and Si:Al are also presented. Direct thermodynamic measurements of the work functions of bound multi-exciton complexes in Al, B, P and Li doped Si are also presented. A new model for the decay of electron-hole-droplets in Ge is presented. Dissert. Abstr.

N79-20883 Stanford Univ., Calif.
MOESSBAUER EFFECT STUDIES OF Tm IONS IN METALLIC COMPOUNDS IN A 3He - 4He DILUTION REFRIGERATOR Ph.D. Thesis
Yusuf Ali Mahmud 1978 156 p
Avail: Univ. Microfilms Order No. 7905900

Moessbauer absorption spectra of one semiconducting and several metallic Tm compounds yield magnetic dipole and electric quadrupole hyperfine interactions associated with the various 4f electronic ground states. The material TmAl2 has a 4f ground state similar to the free ion limit of the Tm(3+)(3H6) configuration. The other Tm(3+) materials studied, TmB12, TmAl2, and TmS all have cubic ion symmetry, and all show reduced hyperfine interactions associated with this higher symmetry. The only material studied which contains predominantly Tm(2+)(F7/2) ions was TmTe. The hyperfine interactions observed for this material are believed to be near the (F7/2) free ion limit, and measurements above magnetic ordering temperature verify the non-cubic symmetry of the TM(2+) ions in TmTe (in spite of the cubic NaCl crystal structure). Dissert. Abstr.

N79-20884 Carnegie-Mellon Univ., Pittsburgh, Pa.
A STUDY OF INTERFACIAL REACTION IN Al-Cu THIN FILMS Ph.D. Thesis
Michael Patrick Shearer 1978 120 p
Avail: Univ. Microfilms Order No. 7904882

Interdiffusion in aluminum-copper thin films were studied by Auger electron spectroscopy, electron microscopy and an electrical resistance measurement technique. The interdiffusion process in aluminum-copper thin films are characterized by three distinct parabolic processes in order of decreasing rapidity; diffusion of aluminum along copper grain boundaries, copper along aluminum grain boundaries and homogenization of the grain interiors by volume diffusion. The process is complicated by the fact that Al2Cu nucleates and grows along the boundaries during the grain boundary diffusion process. Nevertheless, interfacial reactions are described and analyzed in terms of the evolution of resistance with time. Dissert. Abstr.

N79-20885 Arizona Univ., Tucson.
AN ELECTRON MICROSCOPE INVESTIGATION OF ION-IMPLANTED SILICON CONTAINING PRE-INDUCED STACKING FAULTS Ph.D. Thesis
Craig Martin Shevlin 1978 172 p
Avail: Univ. Microfilms Order No. 7906412

Single crystal wafers of n-type silicon in the (001) orientation were implanted with either boron or silicon ions to a dose of 10 to the 5th power, and subsequently annealed in dry nitrogen at 600, 800, or 1000 C. Prior to implantation the wafers were randomly abraded with 0.5 micron diamond paste and oxidized for either 5 or 40 min at 1050 C in a stream ambient. This treatment produced extrinsic stacking faults, in densities of approximately 10 to the 7th power/sq cm, lying on all four (111)-type planes and intersecting the top surface of the wafer. The mechanism for the nucleation of stacking faults in damaged silicon crystals was elucidated. Very early stages of the oxidation process in both randomly and directionally abraded wafers were studied. Transmission electron microscopy results show that Lomer prismatic dislocations are produced during the abrasion process, and that these dislocations are present after short oxidation times. Dissert. Abstr.

N79-20886 Northwestern Univ., Evanston, Ill.
ATOMIC ARRANGEMENTS IN ORDERED AND DISORDERED VOx Ph.D. Thesis
Masahiko Morinaga 1978 402 p
Avail: Univ. Microfilms Order No. 7903328

Integrated intensities were measured from VOx single crystals with x = 0.80, 0.94, 1.01, 1.11 and 1.25. From a least-squares refinement it was found that there are interstitial vanadium ions in disordered VOx, the concentration of which changes from 0 to minus 0.5% to 3% with composition x. The overall temperature factor of VOx is very large, approximately (0.93 to 1.43 square angstrom units), and increases with x, suggesting that there are large static and thermal displacements of ions in VOx. The diffuse X-ray scattering was measured from VOx single crystals with x = 0.89, 1.17 and 1.28. For x less than 1 there is an increased concentration of anion vacancies. For x greater than 1 there are interstitial vanadium ions surrounded by vacancy clusters, but there is no correlation between the interstitial vanadium ions. The defect structors found in VOx show that some compositions resemble metallic TiOx and some resemble semiconducting FexO. Dissert. Abstr.

N79-20887*# Cornell Univ., Ithaca, N. Y.
TEM OBSERVATIONS ON GRAIN BOUNDARIES IN SINTERED SILICON, PART 1 Annual Report, 1 Jan. 1977 - 30 Sep. 1978
D. Ast and H. Foll 30 Sep. 1978 29 p refs Prepared for JPL
(Contract JPL-954852)
(NASA-CR-158416) Avail: NTIS HC A03/MF A01 CSCL 20L

Grain boundaries in silicon with a predetermined orientation were prepared by the sintering of two single crystals. A combination of standard transmission electron microscopy and lattice imaging was used to investigate the structure of the boundaries produced. Low angle grain boundaries on (100) and (111) planes, and twin boundaries on (111) planes are discussed in detail. Author

N79-20888*# National Aeronautics and Space Administration, Washington, D. C.
AUGER ELECTRON EMISSION DUE TO INCIDENT PARTICLE IN Ar(+), Ne(+) AND Na(+) COLLISIONS WITH DIFFERENT SOLID TARGETS
C. Benazeth, N. Benazeth, L. Viel, and C. Leonard Mar. 1979 9 p refs Transl. into ENGLISH from Compt. Rend., Ser. B (France), v. 287, no. 10, 23 Oct. 1978 p 253-256 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Toulouse Univ., Solid State Phys. Lab.
(Contract NASw-3199)
(NASA-TM-75416) Avail: NTIS HC A02/MF A01 CSCL 20L

The L23 Auger spectra of Ar, Ne and Na from Ar(+)-Ti, Ne(+)-Mg, Ne-A1, Na(+)-Be, Na(+)-Mg and Na(+)-A1 collisions were obtained. For Ar, L23 MM Auger electrons are emitted from the fast moving incident projectiles and a Doppler broadened structure is observed. The Ne and Na Auger spectra are due to Auger transitions with single or double 2p vancancies in the initial state of the implanted Ne atoms or surface trapped Na atoms. Author

N79-20889*# Guests Associates, Inc., Huntsville, Ala. Advanced Materials Div.
THERMAL ANALYSIS OF BRIDGMAN-STOCKBARGER GROWTH Final Technical Report
Frederick W. Knopf 15 Mar. 1979 98 p refs
(Contract NAS8-33204)
(NASA-CR-161193; AMD-79-TR1) Avail: NTIS HC A05/MF A01 CSCL 20B

A thermal analysis of a cylindrical HgCdTe sample in a Bridgman-Stockbarger crystal growth configuration was conducted with emphasis on the thermal profile, interface shape and position, and the thermal gradients at the liquid-solid interface. Alloys of HgTe and CdTe with compositions approximating 20 percent CdTe, 80 percent HgTe were used. This composition results in a bandgap suited for the detection of 10.6 micron CO2 radiation. The sensitivity of the sample thermal characteristics to important growth parameters, such as thermal diffusivities, thermal conductivities, furnace temperature profile, ampoule dimensions, and growth velocity was assessed. Numerical techniques and associated computational models necessary to analyze the heat transfer process within the sample and the Bridgman-Stockbarger boundary conditions were developed. This thermal analysis mode was programmed in FORTRAN V, and is currently operational on the MSFC Univac 1100 system. A.R.H.

N79-20890# North Texas State Univ., Denton. Dept. of Physics.
INVESTIGATION OF LASER OPTICAL BIASING ON THE QUANTUM TRANSPORT PROPERTIES OF n-InSb Annual Summary Report, 1 Oct. 1977 - 30 Sep. 1978
David G. Seiler Oct. 1978 147 p refs
(Contract N00014-76-C-0319)
(AD-A063161) Avail: NTIS HC A07/MF A01 CSCL 20/12

The interaction of CO2 and CO laser radiation with the semiconductor InSb has been studied at liquid helium temperatures with the Shubnikov-de Haas effect and the photoconductivity at zero magnetic field. The electron heating that results is characterized by a determination of the electron temperature for various CO2 and CO laser frequencies and powers. The CO2 laser-induced heating is shown to result from free carrier absorption processes, while the CO laser-induced heating is shown to result from impurity level and/or direct interband transitions. Author (GRA)

N79-20891# Hughes Research Labs., Malibu, Calif.
ION IMPLANTATION OF WIDE BANDGAP SEMICONDUCTORS Final Report, 1 Oct. 1977 - 30 Sep. 1978
C. L. Anderson Dec. 1978 21 p refs
(Contract N00173-78-C-0070)
(AD-A062367) Avail: NTIS HC A02/MF A01 CSCL 20/12

The principal dopant studied under this contract is Si (n-type). Topics covered in this report include (1) encapsulation technology, (2) transferability of Si implantation technology using plasma-deposited silicon nitride, encapsulation, and (3) problems

associated with performing channeling into (110) crystal axes of a (100)-oriented GaAs wafer. Author (GRA)

N79-20892# Science Applications, Inc., McLean, Va.
SOFT X-RAY PHOTOEMISSION AND CHARGE DEPOSITION NEAR MATERIAL INTERFACES Final Technical Report, 17 Oct. 1977 - 1 Feb. 1978
D. J. Strickland, D. L. Lin, V. W. Pine, and W. L. Chadsey Griffiss AFB, New York RADC Aug. 1978 102 p refs Sponsored in part by DNA
(Contract F19628-77-C-0181)
(AD-A062332; RADC-TR-78-183) Avail: NTIS HC A06/MF A01 CSCL 07/4

The work reported here comes under two distinct headings: soft X-ray photoemission and charge deposition profiles near irradiated material interfaces. The first electron backscatter results using the SXRP code are reported. Good agreement is obtained with measurements for 5 keV electrons incident on Al. The effect of elastic scattering on the photoemission spectrum is analyzed in further detail following the initial observations made in a previous DNA contract. Additional code validation tests plus the good agreement with measurements for backscatter confirm the previous result that scattering significantly effects the photoemission spectrum. A simple technique is presented which relates the inner shell ionization IMFP to the corresponding photoionization cross section. The technique is tested on the K and L shells of Al and gives IMFP's which agree well with more rigorous results. The development of an empirical photoemission code is reported along with spectra and yields for exploding wire sources incident on Al, Au, Ag, and C. Finally, charge deposition profiles for several material configurations containing thin foils are obtained with the POEM code and compared with data by Frederickson. In general, good agreement is achieved. Author (GRA)

N79-20893# General Electric Co., Schenectady, N. Y.
SOLID STATE MATERIALS DERIVED FROM PLANAR METAL COMPLEXES Final Scientific Report, 1 Jul. 1975 - 30 Sep. 1978
L. V. Interrante and John S. Kasper Dec. 1978 44 p refs
(Contract F44620-76-C-0006)
(AD-A062619; SRD-78-178; AFOSR-78-1627TR) Avail: NTIS HC A03/MF A01 CSCL 07/3

This report describes work carried out over the period 1 July 1975 to 31 Oct. 1978 on the contract 'Solid State Materials Derived from Planar Metal Complexes'. The principal focus of this work has been on the preparation and study of pi-donor-acceptor compounds derived from the interaction of the organic donors, tetrathiafulvalene and tetrathiotetracene, with bis(1,2-ethylenedithiolene) metal complexes as the pi-acceptors. These new compounds have been studied using electrical conductivity, magnetic susceptibility, and various other types of solid state property measurement techniques. In addition, the crystal structures have been characterized using single crystal X-ray diffraction methods. The results have been used to obtain information regarding the electronic and magnetic interactions occurring in the solid state and to derive synthetically useful structure-property relationships. GRA

N79-20894# Naval Research Lab., Washington, D. C.
INTEGRAL REFLECTION COEFFICIENTS, R, FOR CURVED AND GROUND LiF AND ADP
L. S. Birks, J. W. Sandelin, and D. B. Brown 29 Nov. 1978 10 p
(AD-A062450; NRL-MR-3880) Avail: NTIS HC A02/MF A01 CSCL 07/4

Integral reflection coefficients, R, were measured for flat and curved crystals of LiF and ADP to determine whether or not curving degraded their diffracting power. There was, in fact, an increase in measured R values for the curved crystals except for 2 order diffraction of Cr radiation from ADP which decreased by 10%. Theoretical R values were calculated for all of the experimental situations and showed good agreement on an absolute as well as a relative basis. Author (GRA)

N79-20895# Varian Associates, Palo Alto, Calif.
RESEARCH ON LONG WAVELENGTH BIAS-ASSISTED PHOTOEMITTER Final Report, 1 Aug. 1975 - 31 Jul. 1978
J. S. Escher Sep. 1978 48 p refs
(Contract DAAG29-76-C-0002)
(AD-A062473; ARO-13266-4-EL) Avail: NTIS HC A03/MF A01 CSCL 20/12

Transferred-electron photoemission to 1.7 microns has been achieved for the first time from a Ag/p-In(.53)Ga(.47)As cathode. A peak reflection-mode quantum yield of 1.6% at 1.3 microns was achieved. Measurements of the optical absorption coefficient and photoluminescence spectrum of LPE-grown In(.53)Ga(.47)As/InP(100) samples are presented. Monte Carlo calculations of the energy distributions of photogenerated electrons reaching the emitting surface are also discussed. Author (GRA)

N79-20896# California Univ., Irvine.
THEORY OF SURFACE POLARITONS IN n-TYPE SILICON IN THE PRESENCE OF A dc CURRENT Final Report
B. G. Martin, A. A. Maradudin (McDonnell-Douglas Corp., St. Louis), and R. F. Wallis Dec. 1978 27 p refs
(Contract N00014-76-C-0121)
(AD-A063097; TR-78-51) Avail: NTIS HC A03/MF A01 CSCL 20/12

A theoretical investigation has been carried out on the effect of a drift current on surface polaritons in n-type silicon. The current direction is taken to be parallel to the direction of propagation of the surface polaritons. From the dispersion curves, there is evidence that an interaction takes place between the current and the polaritons which gives rise to polariton instability or amplification for certain frequency ranges. These instabilities are believed to be due to the presence of the surface. Author (GRA)

N79-20897# National Bureau of Standards, Washington, D. C. National Engineering Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: ANGULAR SENSITIVITY OF CONTROLLED IMPLANTED DOPING PROFILES Final Report
Robert G. Wilson, Howard L. Dunlap, Douglas M. Jamba, and David R. Myers Nov. 1978 64 p refs Prepared in cooperation with Hughes Res. Labs., Malibu, Calif.
(ARPA Order 2397)
(PB-289134/9; NBS-SP-400-49) Avail: NTIS HC A04/MF A01 CSCL 20L

Ion implantation can be used to produce accurately controlled doping profiles for silicon devices and integrated circuits. The angle at which the ion beam must strike the substrate in order to maintain control over the channeled and random equivalent depth distributions of carriers as measured by 1-MHz differential capacitance-voltage (C-V) profiling is discussed. A method to calculate the classical critical angle for channeling is presented. Data are presented that characterize with substrate orientation, incident ion species, and incident ion energy, for a range of critical angles. The degree of control of the angle between the ion beam and the crystallographic orientation in the substrate is presented. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N79-20898 Stanford Univ., Calif.
THOMAS-FERMI THEORIES OF STRUCTURE. 1: A COLLECTIVE CORE - VALENCE ELECTRON MODEL OF REAL ATOMS. 2: A RELATIVISTIC QUANTUM FIELD THEORY OF FINITE NUCLEI Ph.D. Thesis
Frederick Edward Serr 1978 168 p
Avail: Univ. Microfilms Order No. 7905926

Approximate models are examined for two fundamental many-body systems: the electron cloud in atoms and baryons, and mesons in atomic nuclei. The simplicity of the models for both the widely different system derives, at least in part, from the Thomas-Fermi approximation. Dissert. Abstr.

N79-20899*# National Aeronautics and Space Administration, Washington, D. C.
POSSIBILITIES OF SURFACE COATING FOR THERMAL INSULATION
E. Poeschel and G. Weisser Mar. 1979 16 p refs Transl. into ENGLISH from Deutsche Ges. fuer Metallkunde (Oberursel), 1976 p 148-158 Presented at Tagung in Verbundwerkstoffe, Constance, West Germany, 3 Mar. - 2 Apr. 1976 Original language document announced as A78-38210 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Battelle-Institut, Frankfurt am. Main
(Contract NASw-3199)
(NASA-TM-75399) Avail: NTIS HC A02/MF A01 CSCL 20M

Calculations performed for pulsating heat sources indicate a relatively thin (200-1000 micron) coating can lower temperature both inside and on the surface of a construction material. Various coating materials (including zirconium dioxide) are discussed, together with possible thermic stresses and ways to deal with the latter. Author

N79-20900# Argonne National Lab., Ill. Applied Physics Div.
NUMERICAL THERMAL MIXING IN EULERIAN CALCULATIONS OF COUPLED THERMO/HYDRODYNAMIC MOTIONS
J. J. Sienicki and P. B. Abramson Nov. 1978 54 p refs
(Contract W-31-109-eng-38; DOE-40-550-75)
(ANL-78-101; NUREG-CR-0594) Avail: NTIS HC A04/MF A01

Eulerian computer codes for the combined thermodynamic and hydrodynamic analysis of accident progression in nuclear reactors have a major drawback: they do not conserve thermodynamic potential energy. Eulerian schemes allow mass and energy to flow through calculational cells which are fixed in space. Pressures that drive the hydrodynamics are calculated from the average energy contents of the cells - i.e., the cell-by-cell pressure is found from the cell-by-cell energy per unit mass. Since mass and energy convect from cell to cell, at any time step the pressure of any cell represents the mass weighted average energy of that cell. Thus mass at higher specific energy is assumed by the nature of an Eulerian scheme to come instantaneously at each time step to thermal equilibrium with other mass in the cell at lower specific energy. It is shown that such numerical thermal mixing is unavoidable with pure Eulerian schemes and is a significant source of error in accident calculations. A.R.H.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N79-20901*# Texas Univ. at Austin. Lyndon B. Johnson School of Public Affairs.
SHELF STABLE MEALS FOR PUBLIC SECTOR USES
Jurgen Schmandt, ed. 1977 66 p refs Report of a Conf. on the NASA Meal System, Washington, D. C., 6-7 Jun. 1977; sponsored by NASA and the Lyndon B. Johnson School of Public Affairs Sponsored by NASA
(NASA-CR-158354; LC-77-83761) Avail: NTIS HC A04/MF A01 CSCL 05K

The NASA Meal System was developed with three simple concepts in mind: (1) nutritious, conventional foods are packaged in single-serving units and assembled into complete meals; (2) the meals have an extended shelf-life and can be transported and stored without need for refrigeration or freezing; (3) preparation of the meal by the consumer is an easy task which is accomplished in ten minutes or less. The meal system was tested in 1975 and 1976 by different groups of elderly individuals. NASA and the LBJ School of Public Affairs sponsored a national conference to report on the demonstration of the meal system for the elderly and to explore potential uses of the system for social services, institutional feeding programs, disaster relief, and international aid. The proceedings of the conference and how different groups assessed the potential of the meal system are reported. G.Y.

N79-20902# National Science Foundation, Washington, D. C. Div. of Science Resources Studies.
DETAILED STATISTICAL TABLES. GRADUATE SCIENCE EDUCATION: STUDENT SUPPORT AND POSTDOCTORALS, FALL 1977
Nov. 1978 219 p
(PB-289718/9; NSF-78-315) Avail: NTIS HC A10/MF A01 CSCL 05I

Data were requested from 7,951 graduate science and engineering departments in 370 Ph.D.-granting institutions (including 105 medical schools) and an additional 1,562 departments in 326 master's granting institutions. Data are considered matched for 1975-77 trend series statistics. The tables provide statistics on graduate enrollment and support patterns, level of study, sex, citizenship, and post-doctoral utilization. GRA

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N79-20903* National Aeronautics and Space Administration, Washington, D. C.
MANAGEMENT: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Mar. 1979 103 p refs
(NASA-SP-7500(13)) Avail: NTIS HC A06 CSCL 05A

This bibliography lists 344 reports, articles, and other documents introduced into the NASA scientific and technical information system in 1978. Author

N79-20904# North Carolina State Univ. at Raleigh.
FUNDAMENTAL CONCEPTS IN DISCRETE OPTIMIZATION AS RELATED TO CLASSES OF SCHEDULING PROBLEMS Final Report, 15 May 1972 - 14 Aug. 1978
Salah E. Elmaghraby 10 Nov. 1978 22 p refs
(Grants DAHC04-75-G-0181; DAAG29-76-G-0181; DA-ARO-(D)-31-124-72-G106)
(AD-A062129; ARO-10202.12-M; ARO-131-10-M) Avail: NTIS HC A02/MF A01 CSCL 12/2

Work accomplished over the first three years (1972-75) may be summarized as follows: (1) An extensive study of models for optimally scheduling lots of N products on a single processor under various demand process structures. (2) Solution of a problem of scheduling N jobs on parallel processors to minimize a penalty function based on job due dates when there are no precedence relations among jobs. (3) Two studies treating the efficient solution of minimum cost flow problems. (4) Research on methodologies for discrete optimization related to: (1) Tree search in methods of implicit enumeration; (2) Circumventing the 'curse of dimensionality' in dynamic programming; and (3) The reduction method of integer programming for a specialized version of the generalized assignment problem. (4) Surveys of past and current research in: (1) Scheduling multiple processors; (2) Flow networks; (3) Project planning networks; (4) Basic concepts used in branch-and-bound; and (5) Production planning. GRA

N79-20905# California Univ., Berkeley. Operations Research Center.
DYNAMIC THEORY OF PRODUCTION CORRESPONDENCES. PART 4
Ronald W. Shephard and Rokaya A. Al-Ayat Aug. 1978 67 p
(Contract N00014-76-C-0134; Grant NSF MCS-77-16054)
(AD-A062470; ORC-78-15) Avail: NTIS HC A04/MF A01 CSCL 05/1

Chapter 10 of a monograph on a Dynamic Theory of Production Correspondences is presented. A network of correspondences is defined and properties are investigated. General technical coefficient form of network correspondences are introduced and several special structures are considered with algorithms for computing greedy histories of input and output rate histories. Author (GRA)

N79-20906# National Science Foundation, Washington, D. C. Div. of Science and Resources Studies.
DETAILED STATISTICAL TABLES. RESEARCH AND DEVELOPMENT IN INDUSTRY, 1976. FUNDS, 1976. SCIENTISTS AND ENGINEERS, JANUARY 1977 Final Surveys of Science Resources Series
Dec. 1978 82 p
(PB-289719/7; NSF-78-314) Avail: NTIS HC A05/MF A01 CSCL 05A

Data on the dollar volume of research and development performed in the industrial sector, sources of financing, numbers of R&D scientists and engineers, and other economic characteristics of the industrial R&D effort are presented. GRA

N79-20907# Auburn Univ., Ala. Water Resources Research Inst.
MANAGEMENT OF LOCAL WATER SYSTEMS IN ALABAMA. PART 1: THE CASE OF CALHOUN AND CLEBURNE COUNTIES. PART 2: SOME POLITICAL AND ECONOMIC ASPECTS OF WATER AGENCIES IN ALABAMA
William M. Kimmelman Sep. 1978 117 p refs Sponsored by Dept. of the Interior Prepared in cooperation with Alabama Univ., Birmingham
(PB-289222/2; WRRI-Bull-34-Pt-1; WRRI-Bull-34-Pt-2; W79-01536; OWRT-A-050-ALA(1)) Avail: NTIS HC A06/MF A01 CSCL 13B

Two public water systems in Calhoun and Cleburne Counties, Alabama were studied. The focus is on major political and economic dimensions that play a key role in the management of water systems in Alabama. It is shown that the problem of water management is less one of overall supply than the lack of necessary political-economic organizations in getting water from where it is to where it is needed. While concentrating on local public water systems which provide direct water services, how state agencies establishing to coordinate, regulate and influence water use can facilitate or inhibit the performance of local public water supply system also considered. GRA

N79-20913# Hughes Aircraft Co., Canoga Park, Calif.
GLOBAL POSITIONING SYSTEM TACTICAL MISSILE GUIDANCE
Frederick W. Hardy and C. David DePriest (Air Force Armament Lab.) *In* AGARD The Impact of Integrated Guidance and Control Technol. on Weapons Systems Design Dec. 1978 12 p refs (For primary document see N79-20009 11-01)
Avail: NTIS HC A11/MF A01

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N79-20908* National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY. A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS
Jan. 1979 77 p
(NASA-SP-7039(14)-Section-1) Avail: NTIS HC E04 CSCL 05B

Abstracts are cited for 213 patents and applications for patent introduced into the NASA scientific and technical information system during the period of July 1978 through December 1978. Each entry consists of a citation, an abstract, and in most cases, a key illustration selected from the patent or application for patent. G.Y.

N79-20909* National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY. A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES
Jan. 1979 609 p This issue supersedes all previous index sections
(NASA-SP-7039(14)-Section-2) Avail: NTIS HC E06 CSCL 05B

This issue of the Index Section contains entries for 3512 patent and applications for patent citations covering the period May 1969 through December 1978. The Index Section contains five indexes --- subject, inventor, source, number, and accession number. Author

N79-20910*# California Univ., Santa Barbara. Remote Sensing Unit.
GEOBASE INFORMATION SYSTEM IMPACTS ON SPACE IMAGE FORMATS
D. S. Simonett, ed., T. R. Smith, ed., W. Tobler, ed., D. G. Marks, ed., J. E. Frew, ed., and J. C. Dozier, ed. Apr. 1978 137 p refs Workshop held at Santa Barbara, Calif., 11-15 Sep. 1977
(Contract NASw-3118)
(NASA-CR-158406; SBRSU-TR-3) Avail: NTIS HC A07/MF A01 CSCL 05B

As Geobase Information Systems increase in number, size and complexity, the format compatability of satellite remote sensing data becomes increasingly more important. Because of the vast and continually increasing quantity of data available from remote sensing systems the utility of these data is increasingly dependent on the degree to which their formats facilitate, or hinder, their incorporation into Geobase Information Systems. To merge satellite data into a geobase system requires that they both have a compatible geographic referencing system. Greater acceptance of satellite data by the user community will be facilitated if the data are in a form which most readily corresponds to existing geobase data structures. The conference addressed a number of specific topics and made recommendations. G.Y.

N79-20911# National Bureau of Standards, Washington, D. C. National Engineering Lab.
DIMENSIONS/NBS, VOLUME 62, NO. 10, OCTOBER 1978 Monthly Report
Oct. 1978 35 p
(PB-288973/1; NBS-DIM-62-10) Avail: NTIS HC A03/MF A01 CSCL 05B

The monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Going Metric--What's In It For Me, J. Odom; Information Systems Revisited, F Huddle; Are You On the Wanted List, M. Jacobs; The State of Standard Reference Data, D. Johnson; NBS Researchers Win Three 1978 I-R 100 Awards, M. Baum; Digital Sine-Cosine Mini-Stepping Drive, H. Layer; Iron Metal Standard Reference Material; and Managing Information Resources, B. Leong-Hong. GRA

N79-20912# Advisory Group for Aerospace Research and Development, Paris (France).
INFORMATION AND INDUSTRY
Jan. 1979 90 p refs In ENGLISH and FRENCH Meeting held in Paris, 18-19 Oct. 1978
(AGARD-CP-246; ISBN-92-835-0228-0) Avail: NTIS HC A05/MF A01

Industrial information requirements, mechanisms for information transfer, management considerations in information transfer, and representative national programs are presented. For individual titles, see N79-20913 through N79-20926.

N79-20913# British Library, London (England).
THE REQUIREMENTS OF INDUSTRY FOR TECHNOLOGICAL INFORMATION
Michael W. Hill *In* AGARD Inform. and Ind. Jan. 1979 10 p refs (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

Information systems in industry include the following requirements: (1) to give only the information the client wants; (2) to give immediately understandable and applicable answers; (3) to give answers quickly; (4) to be simple to use; (5) to involve only familiar technology; (6) to be readily accessible, preferably locally based; (7) to exploit existing tried, trusted,

and respected channels; (8) to be stable; and (9) to charge fees which clients can readily afford. S.E.S.

N79-20914# Ministry of Economic Affairs, The Hague (Netherlands).
REQUIREMENTS IN SCIENTIFIC AND TECHNICAL INFORMATION (GOVERNMENT VIEWPOINT) [LES BESOINS EN INFORMATION SCIENTIFIQUE ET TECHNIQUE: LE POINT DE VUE DU GOUVERNEMENT]
S. C. Chambaud *In* AGARD Inform and Ind. Jan. 1979 3 p In FRENCH (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

Although the needs of industries for scientific and technical information vary according to the type of enterprise considered, governments can analyze and attempt to meet these needs. Three essential factors which influence the way in which an industry perceives its need for information are the type of industry, its domain of activity, and its status (growing, declining, or stationary). Industries need information concerning research and production methods, technical-juridical information covering patents and licensing, and technical-economic data related to commerce and marketing. Political intervention is required to meet social and economic objectives. Enterprises must be encouraged to innovate in order to strengthen the industrial fabric of the nation and contribute to the international community. All enterprises must be equally supplied with information needed. Transl. by A.R.H.

N79-20915# Ministry of Economic Affairs, The Hague (Netherlands).
REQUIREMENTS FOR LEGAL/ECONOMIC INFORMATION
J. M. vanPoelje *In* AGARD Inform. and Ind. Jan. 1979 4 p (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

Sources of information, kinds of collected information, distribution of information, communication with sources, and communication with users were examined as a means of supplying information in Dutch trade and industry. The Documentation Center of Economic Information Service is described. Publications and automation in information systems are presented. S.E.S.

N79-20916# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
LITERATURE MECHANISMS. INFORMATION MANAGEMENT .N INDUSTRIAL ORGANIZATIONS
Heinz Goehre *In* AGARD Inform. and Ind. Jan. 1979 11 p (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

Information transfer in industrial organizations, information requirements and technological action, channels of information transfer, barriers to information transfer, and information management in Germany are discussed. S.E.S.

N79-20917# Battelle Columbus Labs., Ohio.
COMPUTER MECHANISMS FOR INDUSTRY'S INFORMATION TRANSFER
John B. Fried *In* AGARD Inform. and Ind. Jan. 1979 5 p refs (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

The growth of computer systems in communication and information/data processing is discussed. The present status of data base storage and retrieval, teleconferencing, electronic messages, and conversational models were reviewed. On-line computer systems are described. S.E.S.

N79-20918# Pera, Melton Mowbray, Leicester (England).
TECHNOLOGY TRANSFER FOR MANUFACTURING INDUSTRIES
D. F. Galloway *In* AGARD Inform. and Ind. Jan. 1979 7 p (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

Technology which factories can best utilize, the time and cost of effecting technology transfer, the likely influence of human psychological factors in impeding technology transfer, and the influence the history and the incentives and disincentives of the plant and industry are predicted. The progression of improved manufacturing techniques form the initial stage of scientific possibility to the final stage of extensive profitable application in industry was studied. S.E.S.

N79-20919# Manchester Business School (England).
REVIEW OF SELECTED INFORMATION TRANSFER STUDIES
A. W. Pearson *In* AGARD Inform. and Ind. Jan. 1979 7 p refs (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

Factors which influence the transfer of information in research and development were examined. A wide range of sources of drawn upon to argue that the individual is the most inportant influence on the way in which information is used. The effectiveness of information transfer can be increased by examining the barriers to communication is presented. S.E.S.

N79-20920# King Research, Inc., Rockville, Md.
INFORMATION TRANSFER COST/BENEFIT ANALYSIS
Donald W. King and Nancy K. Roderer *In* AGARD Inform. and Ind. Jan. 1979 10 p refs (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

A framework for performing cost/benefit analysis of information transfer systems is provided. A cost model is developed for each of these components consisting of cost factors such as number of journal articles (for secondary information systems) and cost elements such as labor, equipment, supplies and so on. Improved performance and effectiveness is assumed to lead to increased benefits which can be measured in terms of value, social benefit and so on. S.E.S.

N79-20921# Association of Special Libraries and Information Bureaux, London (England).
EVALUATION OF INFORMATION SERVICES: RESEARCH AND REALITY
P. H. Vickers *In* AGARD Inform. and Ind. Jan. 1979 5 p refs (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

The state of the development of evaluation philosophy and methods are reviewed. The broad scope of evaluation techniques that are required for different types of systems and services is presented. The approach used in evaluating information services is described. The objectives of the service by careful analysis of the information requirements of the organization are defined. S.E.S.

N79-20922# National Research Council of Canada, Ottawa (Ontario). Technical Information Service.
INFORMATION AND ASSISTANCE SERVICES TO THE MANUFACTURING INDUSTRY IN CANADA
G. Kirouac *In* AGARD Inform. and Ind. Jan. 1979 5 p refs (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

The Technical Information Service (TIS) of the National Research Council is a technology transfer service to assist manufacturing industry. TIS is operated through field offices to ensure the most direct contact possible with industry. A question-and-answer service in the field of science and technology is provided. An engineering service to assist industry with its production problems is given. A program to keep industry abreast of new developments is offered. The benefits to industry and government, as well as a recent student program to extend the assistance already given by its regular staff are described. S.E.S.

N79-20923# Dansk Teknisk Oplysningstjeneste, Copenhagen.
A REVIEW OF TECHNOLOGICAL, TECHNICAL AND SCIENTIFIC INFORMATION SERVICES IN DENMARK, 1978
Kjeld Klintoe *In* AGARD Inform. and Ind. Jan. 1979 3 p refs (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

The structure of the Danish industry is described. The aims, objectives, programs, and working methods of technological information services for industry are presented. The person-to-person transfer of technological information was examined. S.E.S.

N79-20924# Bureau National de l'Information Scientifique et Technique, Paris (France).
NATIONAL PROGRAMS WITH RESPECT TO INDUSTRIAL INFORMATION [PROGRAMMES NATIONAUX EN MAT-

IERE D'INFORMATION INDUSTRIELLE]
M. F. Morin *In* AGARD Inform. and Ind. Jan. 1979 4 p In FRENCH (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

Structures created by the French National Bureau of Scientific and Technical Information to meet the needs of small and medium-sized industries include the national orientation service (SOS-DOC) and the regional scientific and technical information agencies (ARIST). The SOS-DOC directs inquirers to organizations with competence for answering specific questions. Service is open to all persons involved in scientific and technical research including instructors, technicians, and the press. The resources available include technical industrial centers for documentation, laboratory, or technical assistance; public libraries, universities, and government agencies. Nine ARIST centers currently carry out, at the request of industries, searches of all available scientific and technical information sources on a regional, national, and international level. A summary of all data gathered is presented to the inquirer in the most economic and appropriate form, according to the nature of the request. Transl. by A.R.H.

N79-20925# Wilkinson (J. B.), Walton (England).
A NATIONAL PROGRAMME FOR UK
J. B. Wilkinson *In* AGARD Inform. and Ind. Jan. 1979 3 p refs (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

The policy of the National Industrial Information Agency is described. The following items are included: (1) use of public libraries as a universal access facility; (2) availability of Commercial information; (3) establishment of Standards and Specifications data banks; (4) industrial contribution; (5) promotion of training facilities; (6) promotion of corporate recognition of the value of the information resource; and (7) establishment of effective user representation. S.E.S.

N79-20926# Advisory Group for Aerospace Research and Development, Paris (France).
TRANSFERRING TECHNOLOGY TO INDUSTRY THROUGH INFORMATION
Louis Mogavero *In its* Inform. and Ind. Jan. 1979 6 p (For primary document see N79-20912 11-82)
Avail: NTIS HC A05/MF A01

A better understanding of the NASA transfer process, how it works, and the levels of effectiveness with which each element operates were studied. Similarities in technologies that generate economic benefits were examined. The role in guiding research and development, extracting its results, and packaging and disseminating the knowledge for specific uses in the industrial marketplace are presented. S.E.S.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N79-20927# Brookhaven National Lab., Upton, N. Y.
ECONOMIC IMPACTS OF A TRANSITION TO HIGHER OIL PRICES
Raymond G. Tessmer, Jr., Steven C. Carhart, and William Marcuse Jun. 1978 63 p refs
(Contract EY-76-C-02-0016)
(BNL-50871) Avail: NTIS HC A04/MF A01

Economic impacts of sharply higher oil and gas prices in the eighties are estimated using a combination of optimization and input-output models. A 1985 base case is compared with a high case in which crude oil and crude natural gas are, respectively, 2.1 and 1.4 times as expensive as in the base case. Impacts examined include delivered energy prices and demands, resource consumption, emission levels and costs, aggregate and compositional changes in Gross National Product, balance of payments, output, employment, and sectoral prices. Methodology is developed for linking models in both quantity and price space for energy service - specific fuel demands. A set of energy demand elasticities is derived which is consistent between alternative 1985 cases and between the 1985 cases and an historical year (1967). A framework and methodology are also presented for allocating portions of the DOE conservation budget according to broad policy objectives and allocation rules. Author

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N79-20928 Committee of the Whole House on the State of the Union (U. S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1979 237 p refs Rept. together with additional views to accompany H.R. 1786 from the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 19 Mar. 1979 (H-Rept-96-52; GPO-41-646) Avail: US Capital, House Document Room

Increases and reductions in NASA's request for funding to support research and development, construction of facilities, and program management are justified in an analysis of H.R. 1786 which is recommended for passage. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N79-20929 California Univ., Berkeley.
A MACROSCOPIC METHODOLOGY FOR TRANSPORTATION POLICY ANALYSIS Ph.D. Thesis
Paul Miron Schonfeld 1978 237 p
Avail: Univ. Microfilms Order No. 7904597

A methodology for urban transportation planning and policy analysis was developed to permit multidimensional and yet integrated assessment of a wide variety of options. The range of options analyzed includes network configuration and scale, modal technology, vehicle design, service policy, traffic management, pricing and other incentives, financing, investment, and regulation options considered either singly or in combinations. The salient features of this methodology are an emphasis on transportation functions rather than spatial detail, the extension of conventional economic theory to account for user contributions in the production of transportation services, and the use of constrained optimization techniques to structure and expand the scope of the analysis. Dissert. Abstr.

N79-20930*# North Carolina Science and Technology Research Center, Research Triangle Park.
A REGIONAL TECHNOLOGY TRANSFER PROGRAM Final Report
1978 38 p
(Contract NASw-3055)
(NASA-CR-158436) Avail: NTIS HC A03/MF A01 CSCL 05B

The final report is presented for the North Carolina Science and Technology Research Center's 14th consecutive contract period as a NASA Industrial Applications Center, serving the information needs of nine Southeastern states. Included in the report are figures for and analysis of marketing efforts, file usage, search delivered, and other services performed for clients; and information on staff changes, workshops, and special projects in 1978. An appendix contains copies of NC/STRC magazine advertisements, letters from clients, and supplementary information on NC/STRC staff and services. G.Y.

N79-20931# General Accounting Office, Washington, D. C. Community and Economic Development Div.
WATER QUALITY MANAGEMENT PLANNING IS NOT COMPREHENSIVE AND MAY NOT BE EFFECTIVE FOR MANY YEARS
Dec. 1978 60 p
(PB-289507/6; CED-78-167) Avail: NTIS HC A04/MF A01 CSCL 13B

A review is reported of the Environmental Protection Agency's administration of its water quality management planning program, more commonly referred to as 208 planning. This report points out the problems that have hindered the effectiveness of the 208 program and problems being experienced by State and areawide agencies which do the planning. GRA

N79-20932# Illinois Univ. at Urbana-Champaign, Urbana. Water Resources Center.
FLUORIDE REMOVAL FROM POTABLE WATER SUPPLIES Final Research Report
Frank W. Sollo, Jr., Thurston E. Larson, and Henry F. Mueller Sep. 1978 41 p refs Prepared in cooperation with Illinois State Water Survey, Urbana
(Contract DI-14-34-0001-8015; OWRT Proj. A-094-ILL(1))
(PB-288969/9; UILU-WRC-78-0136; W79-01351) Avail: NTIS HC A03/MF A01 CSCL 13B

A variety of methods for the removal of fluoride from water were compared. Coagulation with alum at pH level of 6.2 to 6.4 was one of the more effective methods tested. Fluoride was found to be adsorbed by magnesium hydroxide. This occurs in the softening process with magnesium-containing waters, and could be increased by adding both magnesium salts and lime. The formation of fluorapatite by the reaction of fluoride with phosphoric acid and lime was very effective for the remobal of fluoride. Flocculation with iron salts was of little benefit in the removal of fluoride. The fluoride removed was from 2 to 10 percent of the initial concentration. Polyelectrolytes, in general, did not remove fluoride, but were very helpful in obtaining good clarification from some processes and thereby aided in fluoride removal. GRA

N79-20933# Hydrocomp, Inc., Palo Alto, Calif.
PLANNING AND MODELING IN URBAN WATER MANAGEMENT
Anthony S. Donigian, Jr. and Ray K. Linsley Oct. 1978 171 p refs
(Contract DI-14-34-0001-6222)
(PB-289891/4; W79-02288) Avail: NTIS HC A08/MF A01 CSCL 13B

Three hundred forty-nine planning and public works agencies were surveyed to evaluate and analyze the use of modeling for the planning and management of the urban water problems in order to determine the extent of model usage and the impact of modeling on policy and decision making. Eight case studies of modeling applications by cities, counties, and regional agencies are documented. The case studies include a variety of model types and water problems to demonstrate the utility of modeling for urban water planning and management. GRA

N79-20934# Environmental Protection Agency, Washington, D. C. Municipal Construction Div.
USA/USSR SYMPOSIUM ON RECYCLING WATER SUPPLY SYSTEMS AND REUSE OF TREATED WATER AT INDUSTRIAL PLANTS (5TH) HELD AT THE HEADQUARTERS OF GOSSTROY
Apr. 1978 64 p refs Symp. held at Moscow, 12-13 Sep. 1977; sponsored by USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Indust. Sources
(PB-289865/8) Avail: NTIS HC A04/MF A01 CSCL 13B

Reuse of treated waste water by industry is considered with emphasis on water pollution control. The experience of various industries and municipalities within the U.S. and the USSR is discussed. J.M.S.

N79-20935# Michigan Univ., Ann Arbor.
HEALTH EFFECTS OF A WASTEWATER TREATMENT SYSTEM Final Report
Kerby F. Fannin, Kenneth W. Cochran, Helen Ross, and Arnold S. Monto Oct. 1978 68 p refs Prepared in cooperation with IIT Research Inst., Chicago, Ill.
(Grant EPA-R-804973-01)
(PB-289409/5; EPA-600/1-78-062) Avail: NTIS HC A04/MF A01 CSCL 06F

Data obtained as part of a comprehensive community health study conducted during 1965-1971 were utilized to examine the incidence of acute illness in a population surrounding an activated sludge wastewater treatment plant and a control location in Tecumseh, Michigan. Differences in illness incidence occurred from May through October at varying distances from the wastewater treatment plant and persons dwelling within 600 m of this plant appeared to have a greater than expected risk of respiratory and gastrointestinal illness. The data do not, however, demonstrate a causal effect and factors other than the wastewater treatment plant, such as higher rates of illness transmission in areas of higher densities of lower socioeconomic families, could have contributed to these findings. GRA

N79-20936# Department of Transportation, Washington, D. C.
REPORT OF THE HAZARDOUS MATERIALS TRANSPORTATION TASK FORCE
Sep. 1978 169 p
(PB-288815/4; DOT-RSPA-78-2) Avail: NTIS HC A08/MF A01 CSCL 13B

The adequacy and effectiveness of the hazardous materials regulation program, the adequacy and effectiveness of the hazardous materials compliance and enforcement programs, and Federal hazardous materials training programs, and emergency response systems are discussed. The Task Force, based upon its findings and analysis, offered six recommendations for consideration. GRA

N79-20937# Illinois Inst. of Tech., Chicago. Dept. of Environmental Engineering.
SHORT COURSE PROCEEDINGS: APPLICATIONS OF COMPUTER PROGRAMS IN THE PRELIMINARY DESIGN OF WASTEWATER TREATMENT FACILITIES. SECTION 2: USER'S GUIDE AND PROGRAM LISTINGS Final Report
Richard G. Eilers (EPA, Cincinnati, Ohio), Robert Smith (EPA, Cincinnati, Ohio), Stephen P. Graef (Metropol. Sanit. District of Greater Chicago, Ill.), James. W. Male (Mass. Univ., Amherst), Hisashi Ogawa, and Phong Nguyen Sep. 1978 288 p refs
(Grant EPA-R-805134-01)
(PB-289497/0; EPA-600/2-78-185B) Avail: NTIS HC A13/MF A01 CSCL 13B

The use of the program and subroutines is described. Several examples show appropriate input and expected output for a variety of applications. In addition, the theoretical basis for the calculations are shown in the form of conventional mathematical and equivalent fortran equations. The program listing includes the main program and each of 27 subroutines, representing different treatment processes, energy consumption, and cost calculations. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N79-20938 Case Western Reserve Univ., Cleveland, Ohio.
THE KINEMATICS AND SPACE DENSITY OF M DWARF STARS Ph.D. Thesis
Thomas Herbert Robertson 1978 119 p
Avail: Univ. Microfilms Order No. 7902981

An objective prism survey in the red spectral region was completed which covers approximately two percent of the sky at intermediate south galactic latitudes to a limiting magnitude

of V-12 for early M stars and to V-14 for late M stars. More than five hundred late K stars and M stars were detected, of which the vast majority are dwarfs. Upper and lower limits for the luminosity function for early M stars are derived from photographically determined apparent magnitudes and absolute magnitudes obtained from objective prism spectral types. The solar motion is computed from the tangential velocities of the late M dwarfs. The kinematic properties of the late M dwarfs are compared with those determined in other investigations. Some problems associated with the use of objective prism surveys in the red spectral region for the accurate classification of late main-sequence stars are presented. Dissert. Abstr.

N79-20939 George Washington Univ., Washington, D. C.
ON THE EVOLUTION OF PRIMORDIAL BLACK HOLES Ph.D. Thesis
M. Tariq Shams 1978 147 p
Avail: Univ. Microfilms Order No. 7903790

An attempt is made to set up a formalism which can be used to determine the way inhomogeneities could lead to collapse and formation of black holes. The evolution of spherically symmetric inhomogeneities arising in a background Friedmann space is analyzed. The method of solution is to set up a perturbation series strongly convergent for small density fluctuations. The differential equation governing the perturbation of any given order is determined. The first order solutions are used to describe the evolution of the perturbed space starting from a given initial localized over-density. The criteria for collapse are obtained in the model and these criteria are used to determine the number of primordial black holes in a given mass range at a given time. The number spectrum obtained in the calculations is used to qualitatively analyze the radiation from the black holes possibly observe today. Dissert. Abstr.

N79-20940 California Univ., Berkeley.
AN INTERFEROMETER MAP OF VIRGO A AT 1.3 CM LAMBDA Ph.D. Thesis
James Richard Forster 1978 122 p
Avail: Univ. Microfilms Order No. 7904439

The radio galaxy Virgo A(M87, 3C274, NGC 4486) was mapped at 23 GHz (1.3 cm) using an earth-rotation synthesis interferometer. Full polarization maps with 6 by 12 arc second resolution are presented and compared to the 5 GHz maps made with the 5 KM telescope. The linear polarization data are interpreted using a model consisting of a turbulent low density plasma containing both random and systematic magnetic fields and readiating by the synchrotron process. Distributions over the core object are derived for the spectral index, rotation measure, line-of-sight systematic field strength, turbulent-to-systematic field ratio, thermal electron density and the intrinic transverse systematic field direction. The derived distributions suggest an explosive origin at the position of the galactic nucleus and continuing particle acceleration at sites within the extended components. Dissert. Abstr.

N79-20941*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DETERMINATION OF THE TELLURIC WATER VAPOR ABSORPTION CORRECTION FOR ASTRONOMICAL DATA OBTAINED FROM THE KUIPER AIRBORNE OBSERVATORY
E. F. Erickson, J. P. Simpson, P. M. Kuhn (NOAA, Boulder, Colo.), and L. P. Stearns (NOAA, Boulder, Colo.) Apr. 1979 13 p refs
(NASA-TM-78582; A-7805) Avail: NTIS HC A02/MF A01 CSCL 03A

The amount of telluric water vapor along the line of sight of the Kuiper Airborne Observatory telescope as obtained concommitantly on 23 flights is compared with the NASA-Ames Michelson interferometer and with the NOAA-Boulder radiometer. A strong correlation between the two determinations exists, and a method for computing the atmospheric transmission for a given radiometer reading is established. G.Y.

N79-20942*# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.
ANALYSIS OF ULTRAVIOLET SPECTROPHOTOMETRIC DATA FROM COPERNICUS Final Report
Theodore P. Snow, Jr. 17 Apr. 1979 5 p refs
(Grant NsG-5246)
(NASA-CR-158446) Avail: NTIS HC A02/MF A01 CSCL 03A

Ultraviolet spectral data from the OAO 3 satellite are being used to study interstellar absorption lines and stellar and circumstellar lines in hot stars. The interstellar data are beneficial in analyzing the depletions of heavy elements from the gas phase and in elucidating how these depletions depend on physical conditions. Abundances in separate velocity components were determined from line profiles. Observations were carried out for interstellar abundances, both atomic and molecular, towards a number of stars. The better quality data are being analyzed for profile information and the lesser data are being used in curve-of-growth analyses. Molecular observations were carried out as well, N2 was sought; interstellar C2 was detected and its rotational excitation utilized to establish limits in interstellar cloud temperatures. An extensive search for H2O resulted in a tentative identification which will produce new information on chemical reaction rates. Interstellar depletions and grain properties in the rho Ophiuchi cloud, stellar wind variability, and circumstellar lines are also under study. A.R.H.

N79-20943*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGH ENERGY X-RAY OBSERVATIONS OF BL LACERTAE OBJECTS
M. J. Coe, B. R. Dennis, J. F. Dolan, C. J. Crannell, K. J. Frost, L. E. Orwig, and A. R. Engel (Imperial Coll. of Sci. and Technol.) Feb. 1979 10 p refs Submitted for publication
(NASA-TM-80239) Avail: NTIS HC A02/MF A01 CSCL 03B

BL Lac objects are of considerable current interest both because they were recently realized to be a new class of objects and because they were found to be similar in many significant respects to QSOs and Seyfert Galaxies. Since at least one model for the X-ray emission predicts a flattening of the X-ray spectrum above a few keV, several of these sources were studied using the high energy scintillation telescopes on OSO-8 and Ariel-5. With the possible exception of Markaryan 421, only upper limits were obtained for the X-ray emission in the energy ranges 25-60 and 60-130 keV, thereby imposing constraints on any spectral breaks. G.Y.

N79-20944*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WORLD ATLAS OF LARGE OPTICAL TELESCOPES
Stephen Paul Meszaros Mar. 1979 49 p refs Submitted for publication
(NASA-TM-80246) Avail: NTIS HC A03/MF A01 CSCL 03A

By 1980 there will be approximately 100 large optical telescopes in the world with mirror or lens diameters of one meter (39 inches) and larger. This atlas gives information on these telescopes and shows their locations on continent-sized maps. Observatory locations considered suitable for the construction of future large telescopes are also shown. Author

N79-20945*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY OBSERVATIONS OF AM HERCULIS FROM OSO-8
M. J. Coe, B. R. Dennis, J. F. Dolan, C. J. Crannell, K. J. Frost, and L. E. Orwig Feb. 1979 5 p refs Submitted for publication
(NASA-TM-80238) Avail: NTIS HC A02/MF A01 CSCL 03A

The white dwarf binary system AM Herculis (2A1815+500) was observed in X-rays at both low energies (E less 10 keV) and higher energies. The exact shape of the spectrum, particularly at the higher energies, has yet to be determined. Results from the high energy scintillation spectrometer on OSO-8 are presented. These are combined with results published elsewhere obtained concurrently with the proportional counter on the same satellite, thereby giving for the first time coincident observations of AM Her over the range 2 to 250 keV. A.R.H.

N79-20946*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAO 1 OBSERVATIONS OF THE X-RAY PULSAR 4U1626-67
S. H. Pravdo, N. E. White, E. A. Boldt, S. S. Holt, P. J. Serlemitsos,

J. H. Swank, A. E. Szymkowiak, I. Tuohy, and G. Garmire Mar. 1979 22 p refs Submitted for publication
(NASA-TM-79727) Avail: NTIS HC A02/MF A01 CSCL 03A

Results of an observation of the 7-s pulsar 4U1626-67 with the A2 experiments on HEAO 1 are reported. The phase-averaged X-ray spectra which change radically as a function of pulse phase. Included in this spectral change is the sudden appearance and subsequent decay of a continuum or emission feature with a mean energy of 19 keV which contains about 1/2 the power in this spectral range. Pulse timing results include a new determination of the pulse period and a factor 8 reduction in the upper limit for the light travel time for orbital periods between 1 and 7 hours. The findings for this system are discussed and compared with the general nature of pulsar spectra. G.Y.

N79-20947*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF THE TRANSIENT X-RAY SOURCE 4U0115+63
L. A. Rose, S. H. Pravdo, L. J. Kaluzienski, F. E. Marshall, S. S. Holt, E. A. Boldt, R. E. Rothschild, and P. J. Serlemitsos Mar. 1979 25 p refs Submitted for publication
(NASA-TM-80247) Avail: NTIS HC A02/MF A01 CSCL 03A

Results of HEAO-2 pointed observations and Ariel 5 All Sky Monitor observations of the X-ray transient 4U0115+63 are presented. The transient source pulses with a period of 3.6136 s + or - .0004 s, has a hard spectrum typical of an X-ray binary pulsar, and has a broad iron line emission feature. A discussion of the transient behavior is given and inferences are made concerning the nature of the X-ray source based on the pointed data. G.Y.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N79-20948 California Univ., Santa Barbara.
EFFECTIVE ACTION AND COSMOLOGICAL PARTICLE PRODUCTION Ph.D. Thesis
Massimo Vincenzo Fischetti 1978 182 p
Avail: Univ. Microfilms Order No. 7905562

The effective action method is employed to study the process of particle production in a spatially flat, radiation dominated Friedmann model without incurring in the usual problems. The matter fields alone are quantized and no attempt is made to account for quantum gravity effects. It is found that at the minimum of the expansion the quantum fluctuations have a negative energy density many order of magnitude higher than the Planck density, consistently to a violation of the positive energy condition. The regular geometry is treated as a background for the computation of the production of massless scalar pairs obeying a nonconformally invariant wave equation. The backreaction of the particles created as well as that of the virtual pairs is considered in a consistent perturbative approach and a finite probability of particle creation per proton is obtained.
Dissert. Abstr.

N79-20949 California Univ., Los Angeles.
THE LUMINOSITY FUNCTION OF PLANETARY NEBULAE IN THE MAGELLANIC CLOUDS Ph.D. Thesis
George Howard Jacoby 1978 169 p
Avail: Univ. Microfilms Order No. 7906174

Eighteen and 34 faint planetary nebulae were identified in the central regions of the SMC and LMC, respectively, using on-line/off-line filter photography. The previously known brighter planetary nebulae in these fields, eight in the SMC and seven in the LMC, were also identified. Based on the ratio of the numbers of bright planetary nebulae in the surrounding fields, the total numbers of planetary nebulae in the SMC and LMC are estimated to be 93 and 602, respectively. Equatorial coordinates and finding charts are presented for all the identified planetary nebulae. Monochromatic fluxes are derived photographically and used to determine the luminosity function for Magellanic Cloud planetary nebulae as faint as six magnitudes below the britghtest. Dissert. Abstr.

N79-20950 California Univ., Los Angeles.
THE RADIAL VELOCITY DISPERSION OF PLANETARY NEBULAE IN THE NUCLEAR BULGE OF M31 Ph.D. Thesis
David Grahame Lawrie 1978 156 p
Avail: Univ. Microfilms Order No. 7906178

Forty-two planetary nebulae were identified within the central 1 arcmin. (radius) of the nuclear bulge of M31 using 2.1A bandpass photographs. Each photograph was taken at a different central wavelength, which was varied by changing the temperature of the interference filter. The observed brightness of a planetary nebula in the field was thus modulated from photograph to photograph according to its location in velocity space. Radial velocities for 30 of the planetary nebulae were determined and radial velocity limits were placed on the remaining nebulae in the field. A radial velocity dispersion of 157(+ or - 24) km/sec was derived for the nebulae. From the observed velocity dispersion, the mass-to-light ratio of the inner nuclear bulge of M31, (M/L sub V) sub circled dot = 9.6 (+ or - 3.6), was obtained by application of the virial theorem. Dissert. Abstr.

N79-20951*# National Aeronautics and Space Administration, Washington, D. C.
A COURSE IN CELESTIAL MECHANICS, VOLUME 2
M. F. Subbotin Jun. 1974 605 p Transl. into ENGLISH of the mono. "Kurs Nebesnoy Mechaniki, Tom 2" Moscow-Leningrad, Main Publishing House of Gen. Tech. Lit., 1937 p 1-404 Sponsored by NASA and NSF Transl. by Franklin Book Programs, Inc., Cairo
(NASA-TT-F-14395; TT-72-58009) Avail: NTIS HC A99/MF A01 CSCL 03B

Volume two of a multivolume document is presented and must be regarded as an immediate continuation of the first volume. This volume is concerned with the general theory of perturbative motion, the methods of evaluation of the perturbations of planets and comets and principles on the theory of the motion of the moon. This book may serve as a text-book for undergraduate and postgraduate students and being a sufficiently complete monograph on celestical mechanics, it may be of interest to all scientists working in this field. G.Y.

N79-20952*# National Aeronautics and Space Administration, Washington, D. C.
A COURSE IN CELESTIAL MECHANICS, VOLUME 3
M. F. Subbotin Jun. 1974 330 p refs Transl. into ENGLISH of the mono. "Kurs Nebesnoy Mekhaniki, Tom 3" Moscow-Leningrad, Main Publishing House of Gen. Tech. Lit., 1937 p 1-281 Sponsored by NASA and NSF Transl. by Franklin Book Programs, Inc., Cairo
(NASA-TT-F-14396; TT-72-58010) Avail: NTIS HC A15/MF A01 CSCL 03B

Volume three of a multivolume document is presented and consist of two parts. The first is devoted to the theory of attraction of stationary masses, the fundamental properties of the potential and spherical functions are treated. The attraction of the ellipsoidal bodies is studied in detail. The second part considers the general properties of the figures of equilibrium of fluid masses. The fundamentals of the theory of figures of equilibrium of a homogeneous incompressible fluid are given. A considerable amount of attention is given to the figures of equilibrium, deformed by the attraction of external bodies. Most of the attention is given to the figures of equilibrium of nonhomogeneous fluid bodies, the theory of figures of the planets. G.Y.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N79-20953*# Lockheed Missiles and Space Co., Huntsville, Ala.

OPERATIONAL LOOPWHEEL SUSPENSION SYSTEMS FOR MARS ROVER DEMONSTRATION MODEL Final Report
Wolfgang Trautwein and G. Dean Robinson Dec. 1978 33 p refs
(Contract JPL-955050)
(NASA-CR-158364; LMSC-HREC-TR-D568800) Avail: NTIS HC A03/MF A01 CSCL 03B

The loopwheel (or elastic loop) mobility concept, appears to be uniquely qualified to provide a high degree of mobility at low weight and stowage requirements for the next Mars mission now in the early planning stage. Traction elements compatible with sterilization and Mars surface environmental constraints were designed and are compatible with the rover mass, range and stowage requirements of JPL's point design Mars rover. In order to save cost, the loopwheel suspensions for the demonstration model were made of S-glass/epoxy instead of titanium, alloy specified for flight units. The load carrying fiberglass loop core is covered by a rubber tread on the outside. Reinforced rubber gear belts bonded along the inside edges provide positive engagement and transmission drive torques. A 12 Vdc drive motor with a 167:1 gear head is installed in the payload section of the hull. A chain drive transmits the motor power to the rear sprocket in the demonstration model, whereas future flight units would be directly driven by brushless hub motors within each sprocket and independent four-leg height control. A.R.H.

N79-20954*# National Aeronautics and Space Administration, Washington, D. C.
NASA FACTS: AN EDUCATIONAL PUBLICATION OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. THE PLANET VENUS
[1979] 8 p refs
(NASA-TM-79954; NF-86/12-77) Avail: NTIS MF A01; SOD HC CSCL 03B

Physical features of the planet Venus, including its rotational characteristics and the surface properties observed by NASA's Deep Space Network radar scanner and Soviet spacecraft are examined. Atmospheric composition and circulation and the nature of the Venus clouds are also discussed in this instructional pamphlet. A reading list and student projects are included.
A.R.H.

N79-20955*# National Aeronautics and Space Administration, Washington, D. C.
NASA FACTS: AN EDUCATIONAL PUBLICATION OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. THE VOYAGER MISSION
[1979] 8 p refs
(NASA-TM-79953; NF-89) Avail: NTIS MF A01; SOD HC CSCL 03B

The evolution of Jupiter, as well as its rotation, atmosphere and magnetosphere are described in this third in a series of publications on the exploration of the outer planets by the Voyager spacecraft. Activities for student participation are included with a selected reading list. A.R.H.

N79-20956*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VOYAGER SPACECRAFT RADIO OBSERVATIONS OF JUPITER: INITIAL CRUISE RESULTS
M. L. Kaiser, M. D. Desch, A. C. Riddle (Science Applications Inc., Boulder, Colo.), A. Lecacheux (Observatorie de Paris, Meudon, France), J. B. Pearce (Science Applications Inc., Boulder, Colo.), J. K. Alexander, J. W. Warwick (Science Applications Inc., Boulder, Colo.), and J. R. Thieman Mar. 1979 17 p refs Submitted for publication
(NASA-TM-80240) Avail: NTIS HC A02/MF A01 CSCL 03B

Jupiter's low-frequency radio emission were detected by the planetary radio astronomy instruments onboard the two Voyager spacecraft. The emission is surprisingly similar in morphology but opposite in polarization to the high-frequency Jovian radio noise that were observed with ground-based telescopes for more than two decades. Several possible explanations for the behavior of the low-frequency emission are examined, but none of them is completely satisfactory. G.Y.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N79-20957*# California Univ. at San Diego, La Jolla. Department of Physics.
INFRARED CONTINUUM OBSERVATIONS OF THE SOLAR ATMOSPHERE Final Report
H. Hudson, P. LeVan, and C. Lindsey Mar. 1979 33 p refs
(Grant NsG-7100)
(NASA-CR-158382; UCSD-SP-79-04) Avail: NTIS HC A03/MF A01 CSCL 03B

The far-infrared wavelengths (10 microns to 1 mm) were used to study the spatial and temporal structure of the solar atmosphere. Observational results were obtained on flares, faculae, sunspots, and on the center-to-limb intensity distribution, as well as on time variability within these regions. A program of precise monitoring of slow variations in the integrated solar luminosity was shown to be feasible, and initial steps to implement observations were completed. F.O.S.

N79-20958*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECTS OF GROUND HYDROLOGY ON CLIMATE SENSITIVITY TO SOLAR CONSTANT VARIATIONS
Shu-Hsien Chou (Computer Sciences Corp., Silver Spring, Md.), Robert J. Curran, and George Ohring (Tel-Aviv Univ.) Jan. 1979 47 p refs
(NASA-TM-79705) Avail: NTIS HC A03/MF A01 CSCL 03B

The effects of two different evaporation parameterizations on the climate sensitivity to solar constant variations are investigated by using a zonally averaged climate model. The model is based on a two-level quasi-geostrophic zonally averaged annual mean model. One of the evaporation parameterizations tested is a nonlinear formulation with the Bowen ratio determined by the predicted vertical temperature and humidity gradients near the earth's surface. The other is the linear formulation with the Bowen ratio essentially determined by the prescribed linear coefficient. Author

N79-20959*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR CYCLE VARIATIONS IN IMF INTENSITY
Joseph H. King Mar. 1979 14 p refs Submitted for publication
(NASA-TM-80255) Avail: NTIS HC A02/MF A01 CSCL 03B

Annual averages of logarithms of hourly interplanetary magnetic field intensities, obtained from geocentric spacecraft between November 1963 and December 1977, reveal the following solar cycle variation. For 2 to 3 years at each solar minimum period, the IMF intensity is depressed by 10-15 percent relative to its mean value realized during a broad nine-year period centered at solar maximum. No systematic variations occur during this nine-year period. The solar minimum decrease, although small relative to variations in some other solar wind parameters, is both statistically and physically significant. Author

N79-20960*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONTRIBUTIONS TO THE FOURTH SOLAR WIND CONFERENCE
M. Acuna, K. Behannon, L. Burlaga, R. Lepping, N. Ness, K. Ogilvie, and J. Pizzo Feb. 1979 70 p refs Conf. held at Burghausen, West Germany, 28 Aug. 1978 - 1 Sep. 1978 Submitted for publication
(NASA-TM-79711) Avail: NTIS HC A04/MF A01 CSCL 03B

Recent results in interplanetary physics are examined. These include observations of shock waves and post-shock magnetic fields made by Voyager 1, 2; observations of the electron temperature as a function of distance between 1.36 AU and 2.25 AU; and observations of the structure of sector boundaries observed by Helios 1. A theory of electron energy transport in the collisionless solar wind is presented, and compared with observations. Alfven waves and Alvenic fluctuations in the solar wind are also discussed. A.R.H.

N79-20961*# National Aeronautics and Space Administration, Washington, D. C.
SUN, WEATHER, AND CLIMATE
John R. Herman and Richard A. Goldberg 1978 365 p refs (NASA-SP-426; LC-78-606053) Avail: NTIS MF A01; SOD HC CSCL 03B

The general field of Sun-weather/climate relationships, that is, apparent weather and climate responses to solar activity is introduced and theoretical and experimental suggestions for further research to identify and investigate the unknown causal mechanisms are provided. Topics of discussion include: (1) solar-related correlation factors and energy sources; (2) long-term climatic trends; (3) short-term meteorological correlations; (4) miscellaneous obscuring influences; (5) physical processes and mechanisms; (6) recapitulation of sun-weather relationships; and (7) guidelines for experiments. For individual titles, see N79-20962 through N79-20969.

N79-20962*# National Aeronautics and Space Administration, Washington, D. C.
SUN, WEATHER, AND CLIMATE: INTRODUCTION
In its Sun, Weather, and Climate 1978 p 1-9 (For primary document see N79-20961 11-92)
Avail: NTIS MF A01; SOD HC CSCL 03B

The introduction to this publication is presented. The effects of solar activity on the earth's weather and climate are discussed. A model of the weather and climate machine illustrating its complex and intricate feedback mechanisms is also presented. Various scientists and their publications are cited to give a better understanding and historical account of the progress made in this field of study. G.Y.

N79-20963*# National Aeronautics and Space Administration, Washington, D. C.
SOLAR-RELATED CORRELATION FACTORS AND ENERGY SOURCES
In its Sun, Weather, and Climate 1978 p 11-84 (For primary document see N79-20961 11-92)
Avail: NTIS MF A01; SOD HC CSCL 03B

In the general picture of Sun-weather relationships there are four major facets: the manifestations of solar activity; meteorological and climatological observations and studies; the similarity of periodicities observed in both solar activity and weather phenomena; and the atmospheric physical and chemical processes that allow the relatively minor, solar activity-induced fluctuations in the Sun's energy reaching the earth to influence the vastly more energetic dynamics of the troposphere. Topics discussed include: sunspots; solar electromagnetic radiation; solar corpuscular radiation; galactic cosmic rays; solar magnetic sector structure; and geomagnetic activity. G.Y.

N79-20964*# National Aeronautics and Space Administration, Washington, D. C.
LONG-TERM CLIMATIC TRENDS
In its Sun, Weather, and Climate 1978 p 85-172 (For primary document see N79-20961 11-92)
Avail: NTIS MF A01; SOD HC CSCL 03B

Climatological trends associated with the long and short cycles of sunspot activity were studied by a number of investigators using data spanning more than two centuries. The most common parameters used to define climate are rainfall and temperature and these are used in many of the sun-weather studies. The results of some of these studies are summarized. Surface pressure, a popular parameter to correlate with sunspot number, pressure systems and wind as well as storm tracks are reviewed. The Hale cycle is discussed. The topic of correlation breakdowns and/or reversals is also discussed. Atmospheric electricity as it relates to solar activity is also discussed. Speculation that the stratosphere, especially the ozone layer, might influence sun-weather relationships are reviewed. G.Y.

N79-20965*# National Aeronautics and Space Administration, Washington, D. C.
SHORT-TERM METEOROLOGICAL CORRELATIONS
In its Sun, Weather, and Climate 1978 p 173-207 (For primary document see N79-20961 11-92)
Avail: NTIS MF A01; SOD HC CSCL 03B

Meteorological responses to solar flares are examined, including atmospheric pressure and winds, atmospheric electric quantities, and atmospheric ozone. Geomagnetic activity is used as indirect solar indicator and reported correlations with sea level atmospheric pressure, upper-level pressure and atmospheric circulation, low pressure troughs and vorticity indices, and atmospheric ozone are reviewed. Reported responses to solar magnetic sector boundary crossings are also discussed. G.Y.

N79-20966*# National Aeronautics and Space Administration, Washington, D. C.
MISCELLANEOUS OBSCURING INFLUENCES
In its Sun, Weather, and Climate 1978 p 209-221 (For primary document see N79-20961 11-92)
Avail: NTIS MF A01; SOD HC CSCL 03B

To examine the question of physical mechanisms to link solar variability to meteorological phenomena, it is appropriate to examine arguments that would only create the illusion of a link. One argument is that energy contained in meteorological disturbances propagates upward to ionospheric heights, where it induces fluctuations in the geomagnetic field to produce an observable correlation between magnetic activity and weather. Another argument is that the moon influences the weather, and if there are lunar effects on geomagnetic activity, ergo there would be a correlation between weather and magnetic activity. These two arguments are examined. G.Y.

N79-20967*# National Aeronautics and Space Administration, Washington, D. C.
PHYSICAL PROCESSES AND MECHANISMS
In its Sun, Weather, and Climate 1978 p 223-268 (For primary document see N79-20961 11-92)
Avail: NTIS MF A01; SOD HC CSCL 03B

Various statistical findings and facts concerning sun-weather relationships are assembled and presented as they were reported by numerous investigators. The sum of evidence strongly indicates a relationship between solar activity and meteorological phenomena. The central question centers on what physical processes or mechanisms might act to couple the variable solar energy into the atmospheric system and produce the observed correlations. A number of possible linking mechanisms were suggested, but none are proved. A mix of mechanisms for short term meteorological changes up to long term climatological trends is discussed. G.Y.

N79-20968*# National Aeronautics and Space Administration, Washington, D. C.
RECAPITULATION OF SUN-WEATHER RELATIONSHIPS
In its Sun, Weather, and Climate 1979 p 269-280 (For primary document see N79-20961 11-92)
Avail: NTIS MF A01; SOD HC CSCL 03B

A substantial number of topics were addressed in the previous chapters of this document. This chapter summarizes the principle findings of those topics addressed. An extensive table of previous reported correlations between solar activity and weather and climate is compiled. G.Y.

N79-20969*# National Aeronautics and Space Administration, Washington, D. C.
GUIDELINES FOR EXPERIMENTS
In its Sun, Weather, and Climate 1978 p 281-295 (For primary document see N79-20961 11-92)
Avail: NTIS MF A01; SOD HC CSCL 03B

Because of the complexity of possible relationships between the variable sun and meteorological phenomena, it is clear that a multidisciplinary approach is required in future investigations if progress in understanding is to be achieved. Contributions from and the cooperation of scientists and engineers will be needed in almost every discipline of geophysics. Further, regional, national, and international cooperation efforts are needed. Experiments must be designed to provide quantitative, simultaneous measurements of all the meteorological and solar parameters of pertinence to the particular physical mechanisms under investigation. Desirable measurement parameters are summarized and some guidelines for experimental programs are suggested. G.Y.

N79-20970# Tufts Univ., Medford, Mass. Dept. of Physics.
FINE SCALE RADIO STUDIES OF THE SUN Final Report,

1 Aug. 1978 - 1 Oct. 1978
Kenneth R. Lang 15 Oct. 1978 83 p
(Contract F19628-76-C-0280)
(AD-A062243; AFGL-TR-78-0250) Avail: NTIS
HC A05/MF A01 CSCL 03/2

Major flare eruptions in solar active regions create geophysical disturbances which may seriously disrupt Air Force communication and surveillance systems. This report discusses interferometric observations of solar active regions which show that small-scale, highly circularly polarized sources dominate solar emission at radio wavelengths. The small-scale sources emit intense circularly polarized radiation immediately prior to and during the eruption of solar flares, whereas the circularly polarized emission remains at a lower, constant level whenever the active regions are quiescent and not erupting. The circular polarization of the flare precursors indicates a direct connection with changing magnetic fields in the solar active regions. The precursors reflect changing magnetic fields which may trigger subsequent flare eruptions, and these trigger sources may serve as reliable flare predictors. Studies of the changes in circularly polarized emission during the flare eruptions suggest that the flare eruption process is also the result of changes in magnetic fields. This report further discusses the synthesis mapping technique in which simultaneous solar observations with as many as 55 different interferometer pairs have been used to produce radio wavelength maps of active regions with second of arc angular resolution. GRA

N79-20158*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SOLAR BACKSCATTER ULTRAVIOLET (SBUV) AND TOTAL OZONE MAPPING SPECTROMETER (TOMS) EXPERIMENT
Donald F. Heath, Arlin J. Krueger, and Hongwoo Park (Systems and Appl. Sci. Corp., Riverdale, Md.) *In its* The Nimbus 7 User's Guide Aug. 1978 p 175-212 refs (For primary document see N79-20148 11-12)
Avail: NTIS HC A14/MF A01 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N79-20971*# National Aeronautics and Space Administration, Washington, D. C.
PRELIMINARY RESULTS OF A GAMMA-RAY BURST STUDY IN THE KONUS EXPERIMENT ON THE VENERA-11 AND VENERA-12 SPACE PROBES
Ye. P. Mazets, S. V. Golentskiy, V. N. Il'inskiy, V. N. Panov, R. L. Aptekar, Yu. A. Gur'yan, I. A. Sokolov, Z. Ya. Sokolova, and T. V. Kharitonova Mar. 1979 20 p refs Transl. into ENGLISH of Report no. 599 (Leningrad), 1979 p 1-31 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Academy of Sciences, USSR
(Contract NASw-3199)
(NASA-TM-75610) Avail: NTIS HC A02/MF A01 CSCL 03B

Twenty-one gamma-ray bursts and 68 solar flares in the hard X-ray range were detected on Venera-11 and Venera-12 space probes during the initial 50-day observation period. Major characteristics of the equipment used and preliminary data on the temporal structure and energy spectra of the gamma-ray bursts are considered. The pattern of gamma-ray burst frequency distribution vs. intensity, $N(>S)$, is established. J.M.S.

N79-20972*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE IRAS RADIATION ENVIRONMENT
E. G. Stassinopoulos Dec. 1978 354 p refs
(NASA-TM-80275; X-601-79-7) Avail: NTIS
HC A16/MF A01 CSCL 03B

Orbital flux integration for three selected mission altitudes and geographic instantaneous flux-mapping for nominal flight-path altitude were used to determine the external charged particle radiation predicted for the Infrared Astronomy Satellite. A current field model was used for magnetic field definitions for three nominal circular trajectories and for the geographic mapping positions. Innovative analysis features introduced include (1) positional fluxes as a function of time and energy for the most severe pass through the South Atlantic Anomaly; (2) total positional doses as a function of time and shield thickness; (3) comparison mapping fluxes for ratios of positional intensities to orbit integrated averages; and (4) statistical exposure-time history of a trajectory as a function of energy indicating, in percent of total mission duration, the time intervals over which the instantaneous fluxes would exceed the orbit integrated averages. Results are presented in tables and graphs. A.R.H.

N79-20973*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ST ENVIRONMENT: EXPECTED CHARGED PARTICLE RADIATION LEVELS
E. G. Stassinopoulos Oct. 1978 238 p refs
(NASA-TM-80274; X-601-78-30) Avail: NTIS
HC A11/MF A01 CSCL 03B

The external (surface incident) charged particle radiation, predicted for the ST satellite at the three different mission altitudes, was determined in two ways: (1) by orbital flux-integration and (2) by geographical instantaneous flux-mapping. The latest standard models of the environment were used in this effort. Magnetic field definitions for three nominal circular trajectories and for the geographic mapping positions were obtained from a current field model. Spatial and temporal variations or conditions affecting the static environment models were considered and accounted for, wherever possible. Limited shielding and dose evaluations were performed for a simple geometry. Results, given in tabular and graphical form, are analyzed, explained, and discussed. Conclusions are included. A.R.H.

99 GENERAL

N79-20974# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1978-2
Nov. 1978 86 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-2, Mar.-Apr. 1978 p 53-98 Original French report available from ONERA, Paris FF 36
(ESA-TT-496) Avail: NTIS HC A05/MF A01

The following topics are discussed: noise emitted by turbomachine jets, analysis of a Lambertian type emission from a spherical surface, viscous-inviscid flow matching, models of unsteady combustion of composite propellants, and Cactus-accelerometer measurements of earth radiative balance. For individual titles, see N79-20975 through N79-20979.

N79-20975# European Space Agency, Paris (France).
REMARKS ON THE NOISE EMITTED BY A TURBOMACHINE JET **c71**
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-2 (ESA-TT-496) Nov. 1978 p 1-14 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-2, Mar.-Apr. 1978 p 53-58 Original report in FRENCH previously announced as A78-38696 (For primary document see N79-20974 11-99)
Avail: NTIS HC A05/MF A01

Without regard for entropy noise, three distinct noise sources were analyzed: turbulence, nonhomogeneity of temperature or entropy, and combustion. An equation was obtained in which the state variables are eliminated as far as possible. The form of the equation satisfied by the acoustic agitation potential was obtained so that the three sources mentioned above could be identified. Author (ESA)

N79-20976# European Space Agency, Paris (France).
ANALYSIS OF A LAMBERTIAN TYPE EMISSION FROM A SPHERICAL SURFACE **c46**
Christian Marchal *In its* La Rech. Aerospatiale, Bi-monthly Bull.

No. 1978-2 (ESA-TT-496), Nov. 1978 p 15-25 ref Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-2, Mar.-Apr. 1978 p 59-64 Original report in FRENCH previously announced as A76-38697 (For primary document see N79-20974 11-99)
Avail: NTIS HC A05/MF A01

A scheme is discussed for measuring the infrared radiation of the earth by measuring its presence on a satellite with a homogeneous spherical surface and equipped with a Cactus accelerometer. The infrared radiation is reconstructed by measurements distributed over a sphere concentric to the earth and by a decomposition into spherical harmonics. This reconstruction is based on the assumption that the emission is of the Lambert types. Author (ESA)

N79-20977# European Space Agency, Paris (France).
VISCOUS-INVISCID FLOW MATCHING: NUMERICAL METHOD AND APPLICATIONS TO TWO-DIMENSIONAL TRANSONIC AND SUPERSONIC FLOWS **c02**
Jean-Claude LeBalleur *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-2 (ESA-TT-496) Nov. 1978 p 26-48 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-2, Mar.-Apr. 1978 p 65-76 Original report in FRENCH previously announced as A78-38698 (For primary document see N79-20974 11-99)
Avail: NTIS HC A05/MF A01

An automatic iterative method is proposed for solving two-dimensional problems of strong interaction between a perfect fluid and boundary layers. It can be integrated into numerical methods for solving perfect fluid flows by relaxation. The usual direct iteration is stabilized by means of a local underrelaxation coefficient. A new semi-inverse iteration permits extending a direct perfect-fluid calculation to regions of separation. These regions can be multiple and develop on their own. In supersonic regime, a well-posed problem is solved that involves a downstream boundary condition even when the flow does not obey a simple wave law. The method is applied to a supersonic compression ramp and symmetric profiles in transonic flow.
Author (ESA)

N79-20978# European Space Agency, Paris (France).
MODELS OF UNSTEADY COMBUSTION OF COMPOSITE SOLID PROPELLANTS **c28**
Paul Kuentzmann *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-2 (ESA-TT-496) Nov. 1978 p 49-77 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-2, Mar.-Apr. 1978 p 77-93 Original report in FRENCH previously announced as A78-38699 (For primary document see N79-20974 11-99)
Avail: NTIS HC A05/MF A01

A combustion model is proposed for determining the burning rate of composite solid propellants during a rapid pressure change. A simple model of a nonmetallized propellant is assumed. It calls for a homogeneous condensed phase subjected to heating, an interface where a decomposition reaction takes place, and a gaseous phase that is the site of a reacting between the decomposition products. The model is quasi-phenomenological and makes use of an explicit relation for describing the surface reaction kinetics. Numerical results are obtained, and comparison with the method of Krier et al. (1968) is made. Author(ESA)

N79-20979# European Space Agency, Paris (France).
UTILIZATION OF THE CACTUS ACCELEROMETER IN MEASURING THE EARTH'S RADIATIVE BALANCE **c35**
Jacques Bouttes, Remy Juillerat, and Anne-Marie Mainguy *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-2 (ESA-TT-496) Nov. 1978 p 78-83 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-2, Mar.-Apr. 1978 p 95-97 Original report in FRENCH previously announced as A78-38700 (For primary document see N79-20974 11-99)
Avail: NTIS HC A05/MF A01

Analysis of the orbital flight measurements carried out by means of the Cactus ultra-sensitive accelerometer fitted to the CASTOR satellite has shown that the radiation pressure exerted on the satellite by the sun and the earth can be measured to a sufficiently high accuracy. How, under certain conditions, this type of measurement can be utilized in large-field and wide-range radiometry is demonstrated. Author (ESA)

N79-20980# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1978-3
Dec. 1979 107 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 99-142 Original French report available from ONERA, Paris FF 36
(ESA-TT-522) Avail: NTIS HC A06/MF A01

The following topics are discussed: turbulence statistics in gas with varying entropy: the optical predictions of a high velocity, premixed turbulent flame; flutter suppressors for transonic flight; linearized theory of the plane, unsteady, supersonic flow through a cascade (subsonic leading edge locus); calculation of exchange coefficients for high temperature turbine blades; and in-flight utilization of an optical fiber transmission system on a Falcon 10 aircraft. For individual titles, see N79-20981 through N79-20986.

N79-20981# European Space Agency, Paris (France).
TURBULENCE STATISTICS IN A GAS WITH BROADLY VARYING ENTROPY **c34**
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-3 (ESA-TT-522) Dec. 1979 p 1-15 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 99-103 Original report in FRENCH previously announced as A78-47344 (For primary document see N79-20980 11-99)
Avail: NTIS HC A06/MF A01

The effects of significant heat transfer, resulting in large entropy fluctuations, were taken into account in a statistical analysis of turbulent flow of a nonreacting gas. The equation of state and a system of coherent state variables were set up for flows in which the boundary conditions are steady and for which the statistics can be studied in an arbitrarily small volume. Except for the continuity equation, the fictitious fluid does not obey conservation laws identical with those for physical fluids.
Author (ESA)

N79-20982# European Space Agency, Paris (France).
THEORETICAL PREDICTIONS OF A HIGH VELOCITY PREMIXED, TURBULENT FLAME **c25**
Roland Borghi, Pierre Moreau, and Claude Bonniot *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-3 (ESA-TT-522) Dec. 1979 p 16-45 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 105-116 Original report in FRENCH previously announced as A78-47345 (For primary document see N79-20980 11-99)
Avail: NTIS HC A06/MF A01

A complete model for prediction of turbulent flames was constructed which can be applied to relatively complex situations in which (1) the turbulence is not in equilibrium, (2) the chemical processes are of finite rate but can be reduced to a two-step scheme, and (3) the flame can be perfectly premixed, or be of diffusion type, or have features of both perfectly mixed and diffusion type flames. Experiments on development of an air-CH4 flame between two flows of fresh and burnt pilot gas in a constant-section pipe were performed, and satisfactory agreement with theoretical predictions was obtained. Author (ESA)

N79-20983# European Space Agency, Paris (France).
FLUTTER SUPPRESSOR FOR TRANSONIC FLIGHT **c08**
Roger Destuynder *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-3 (ESA-TT-522 Dec. 1979 p 46-64 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 117-123 Original report in FRENCH previously announced as A78-47346 (For primary document see N79-20980 11-99)
Avail: NTIS HC A06/MF A01

A dynamically similar model of the half-wing of a modern aircraft was equipped with a weighted external tank in order to obtain flutter at transonic velocity. Flutter control is achieved by a classical aileron that produces a reduction in frequency of the lowest flutter mode through the effect of negative stiffness. Significant gain in the critical dynamic pressure and Mach number

were achieved. Different values of the feedback phase were employed in order to determine the stability range as a function of feedback phase. Author (ESA)

N79-20984# European Space Agency, Paris (France).
LINEARIZED THEORY OF THE PLANE, UNSTEADY, SUPERSONIC FLOW THROUGH A CASCADE c02
Pierre Salaun *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-3 (ESA-TT-522) Dec. 1979 p 65-85 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 125-132 Original report in FRENCH previously announced as A78-47347 (For primary document see N79-20980 11-99)
Avail: NTIS HC A06/MF A01

Perturbation pressures were computed by a linearized theory from the starting point of an integral equation in which the unknown function is the pressure difference between two sides of a reference blade and the right-hand side is a known function of the motion. The integral equation was obtained from the boundary condition for the reference blade by setting up a pressure doublet distribution on the blades. Author (ESA)

N79-20985# European Space Agency, Paris (France).
CALCULATION OF EXCHANGE COEFFICIENTS FOR HIGH TEMPERATURE TURBINE BLADES c37
Pierre Michard and Denis Dutoya *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-3 (ESA-TT-522) Dec. 1979 p 86-97 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 133-137 Original report in FRENCH previously announced as A78-47348 (For primary document see N79-20980 11-99)
Avail: NTIS HC A06/MF A01

Results are given of a finite element calculation of the velocity and temperature profiles, momentum thickness, wall fluxes, and the exchange coefficient from the equations of mass, momentum and energy conservation in parabolic form for high-temperature turbulent flow past a turbine blade. The exchange coefficient calculated is defined as the wall flux divided by the difference between the adiabatic wall temperature and the wall temperature. Experimental results for a distributor blade were compared with calculations, and the agreement is satisfactory. Author (ESA)

N79-20986# European Space Agency, Paris (France).
INFLIGHT UTILIZATION OF AN OPTICAL FIBER TRANSMISSION SYSTEM ON A FALCON 10 AIRCRAFT c74
Joseph Taillet and Jean Reibaud *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-3 (ESA-TT-522) Dec. 1979 p 98-103 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-3, May-Jun. 1978 p 139-141 Original report in FRENCH previously announced as A78-47349 (For primary document see N79-20980 11-99)
Avail: NTIS HC A06/MF A01

A device for measuring the current from a potential discharger uses optical fiber for digital transmission. The operation of the device mounted on an aircraft was tested in flight. The first tests show that the signal-to-noise ratio is greatly improved over that of the conventional transmission system. Author (ESA)

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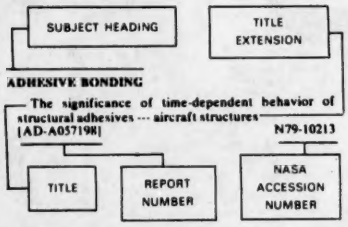

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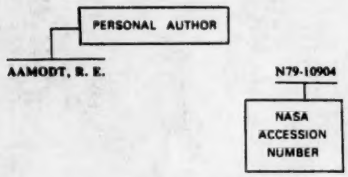

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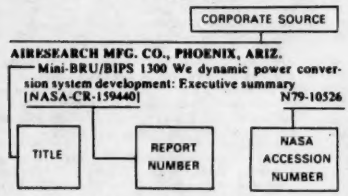

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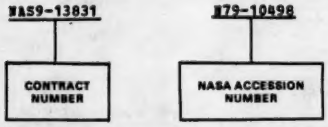

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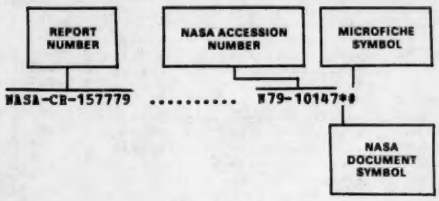

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AFOSR-78-1484TR ..... N79-20403 #
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AFOSR-78-1494TR ..... N79-20374 #
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AFOSR-78-1626TR ..... N79-20362 #
AFOSR-78-1627TR ..... N79-20893 #
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